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Quarterly Journal

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SURVEYING AND MAPPING is the official journal of the Congress and is published quarterly during the months of March, June, September, and December. The Congress welcomes articles and interesting news items for publication in its journal. Manuscripts should be sent to the Chairman of the Publications Committee.

For further information, write to

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SURVEYING AND MAPPING

Robert C. Eller, *Editor-in-Chief*

A QUARTERLY JOURNAL
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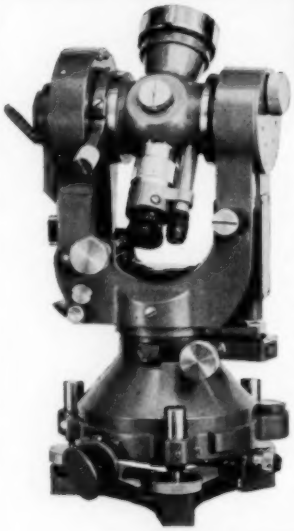

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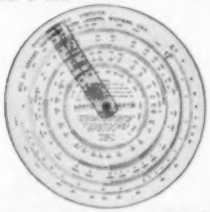

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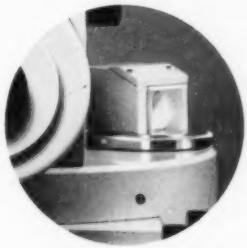

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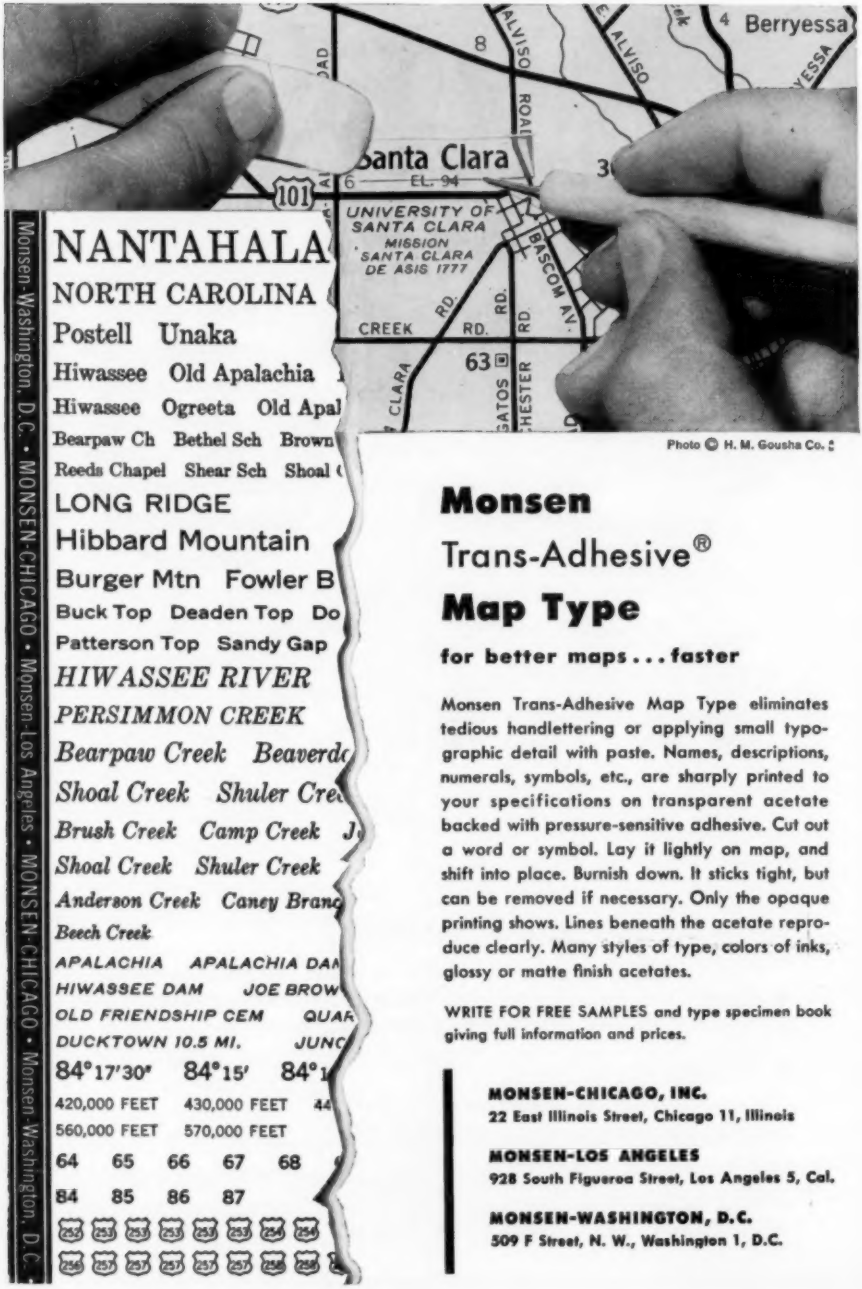

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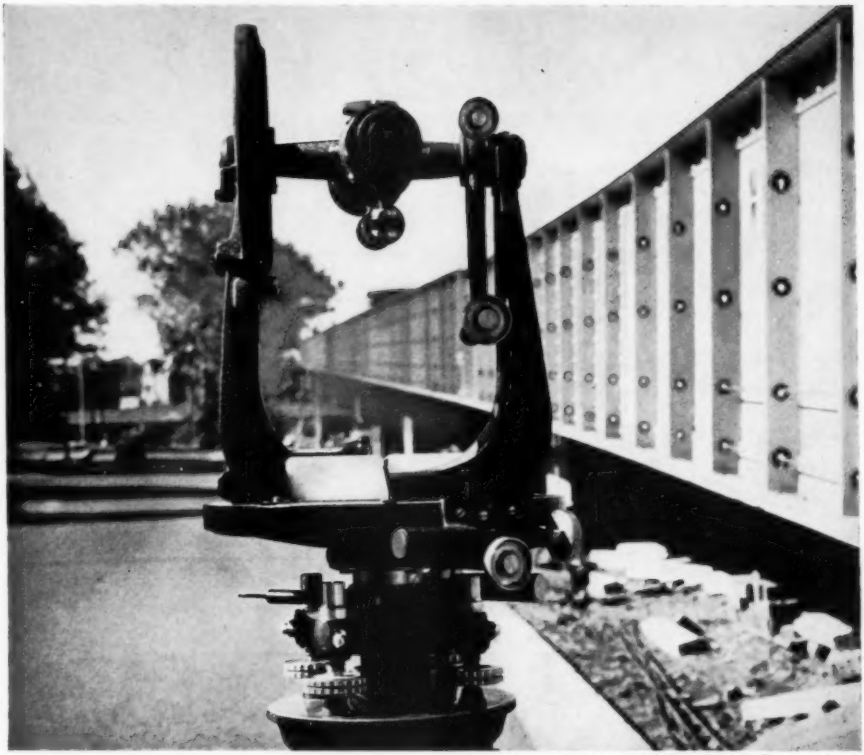

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Second Annual Report to Surveyors

It has been a year now since our first report to you on the progress of "The Surveyor's Notebook."

In the past twelve months these "unusual surveying problems and their solutions" have helped an ever-growing number of engineers and surveyors to use their instruments with greater pleasure and profit. And the page has developed into a professional forum for exchange of useful information—and, sometimes, a discussion of controversial techniques.

Jack Goggin, Marathon, Fla.

Thousands of copies of the collected articles from the first year's series have gone out to surveyors who asked for them. In fact, requests from field men were so numerous that a third printing is nearly exhausted.

And now we are pleased to announce that the second year's stories and tips from "The Surveyor's Notebook" have been gathered together and reprinted in permanent form.

Tractor and Level Whip Mud Flats

The problems and "tricks of the trade" in Series 2 are new. George Gabus of New York City's Board of Water Supply, for instance, tells you his method of eliminating errors in precise alignment. A Cleburne, Texas, surveyor relates what can be done about weather conditions hampering every man in the field.

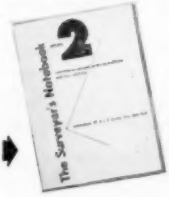
On one page, Chicago's George Salter shows how to subdivide 50,000 acres into nearly 200 lots in accordance with the rights of 600 people. On another, Maryland's Wesson Cook gives his method for bringing in stations in the muck of the Red River Valley.

The Virginian Railway Company's Henry Stanley will cause a great deal of comment, we are sure, with his use of the gradienter in rough terrain; and G. W. Herzog of Shell Oil Company may surprise you with his use of a level on a tractor for whipping mud flats.

Surveying the Antarctic

"A Bit More Mauka, a Few Feet Makai" describes how Prof. Russell Brinker of VPI solved unique problems in tracing old land deeds in Hawaii. And Comdr. Richard Black recounts his adventures while surveying the Antarctic.

John Goggin's method of determining in the field, without calculation, whether or not a survey closes will solve many a headache, as will S. E. Huey's page on getting more out of your compass. And a New Hampshire forester and land surveyor, Gerald Hyde, even tells how a surveyor can add new business with alignment jobs *inside* industrial plants.



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Opinions or assertions expressed in articles in this Journal do not necessarily represent the official views of the CONGRESS.

THE ANNUAL BANQUET AT THE THIRTEENTH ANNUAL MEETING WAS A GAY OCCASION AT WHICH MANY DISTINGUISHED MEMBERS AND GUESTS WERE HONORED.

MURRAY Y. POLING, GENERAL CHAIRMAN OF THE THIRTEENTH ANNUAL MEETING; REAR ADM. ROBERT F. A. STUDDS, PRESIDENT OF THE CONGRESS; AND THE HONORABLE SINCLAIR WEEKS, SECRETARY OF COMMERCE, WHO DELIVERED THE ADDRESS OF WELCOME.

The Thirteenth Annual Meeting

THE Thirteenth Annual Meeting of the American Congress on Surveying and Mapping was held at the Shoreham Hotel in Washington, D. C., on March 23, 24, and 25, 1953. The paid registration reached the record-breaking total of 845, the registrants hailing from every part of the Nation and many foreign countries. The meeting was saddened, at its very outset, by the death of our distinguished colleague and enthusiastic member of the Congress, Prof. Harry Bouchard, of the University of Michigan, who was stricken with a heart attack at Washington National Airport as he arrived to attend the meeting. Despite this tragic note, the 1953 meeting was undoubtedly the biggest and best ever staged by the Congress. The papers presented were of exceptionally high quality; discussions were lively, spontaneous, and highly informative; the exhibitors outdid themselves in displaying the latest in surveying and mapping equipment; and, by no means least in importance, there was plenty of opportunity for friendly personal contact and interchange of ideas among members. It is safe to say that all who attended found the meeting to be very enjoyable as well as profitable.

As many as possible of the papers and discussions heard at the meeting will appear in this and future issues of SURVEYING AND MAPPING.

Opening of the Congress

The exhibits were officially opened at 10:00 a.m. on Monday by our President, Rear Adm. Robert F. A. Studds. The opening session of the Congress was called to order at 11:00 a.m. In his Opening Address, President Studds traced the remarkable growth and increasing importance of the American Congress on Surveying and Mapping since its founding in 1941. The President then introduced the Honorable Sinclair Weeks, Secretary of Commerce, who delivered the Address of Welcome. (The Opening Address by President Studds and the Address of Welcome by Secretary Weeks are printed elsewhere in this issue.)

The opening session was followed by a special luncheon in honor of foreign dignitaries and guests attending the meeting. Dr. Andre C. Simonpietri, presiding at the luncheon, introduced the following guests from foreign countries:

Col. R. Barquin (Cuba)
Lt. Fritz P. DuBois (Peru)
Lt. Roberto F. Corredera (Cuba)
Lt. Som Aksharanugraha (Thailand)
Col. E. D. Baldock (Canada)
Charles C. Lindsay (Canada)
Karl E. Lohse (Canada)
Lt. Comdr. Prapat Bhodhiphala (Thailand)
Lt. Monthian Ruenwongsa (Thailand)
Ba Ngwe (Burma)
N. G. Jorge (Philippines)
Capt. Ugo Giudice (Italy)
Victor A. Salkind (Israel)
Lysandro V. Rodriguez (Brazil).

Plenary Sessions

President Studds presided at the first plenary session on Monday afternoon. The first paper, "Maps—The Necessary Medium to World Progress," was delivered by the well-known cartographer and author, Lloyd A. Brown. In this paper, Mr. Brown pointed out that the development of cartography has occupied the minds of philosophers and scientists throughout the ages, and that the status of mapping in a given country has always been a fair index of its progress.

Guillermo Medina, Chief Engineer, U. S. Navy Hydrographic Office, spoke on "Nautical Charts—The Road Maps of the Sea." Mr. Medina's theme was that the safety of mariners depends on the united action of the hydrographic offices of many nations and that all of these offices are continuously improving the charting of the navigable waters of the globe.

In a paper on "Aviation Development and Its Mapping Needs," Rear Adm. Paul A. Smith, Representative of the U. S. to the International Civil Aviation Organization, described how reliable aerial navigation aids and aeronautical charts have contributed, in large measure, to the remarkable improvement in safety factors and regularity record of scheduled air flights.

The second plenary session was held on Tuesday afternoon, Vice President Benjamin E. Beavin, Sr., presiding. A paper on "Contour Interval Problems" was presented by George D. Whitmore, Chief of Technical Staff, Topographic Division, U. S. Geological Survey. In a series of questions and answers, Mr. Whitmore codified the principal points brought out by the panel on "Selection of Contour Intervals" at the 1952 annual meeting.

Gen. Albert C. Lieber, Assistant Chief of Engineers for Military Operations, Department

of the Army, delivered a paper on "International Cooperation in Mapping," in which he outlined the history of such cooperation, described current activities of the Inter-American Geodetic Survey, and outlined the mapping program of the North Atlantic Treaty Organization.

In a paper entitled "Do We Need Changes in Our Surveying Instruments," Lester C. Higbee, president of W. & L. E. Gurley, outlined some of the improvements that have taken place in American instruments and discussed economic and technical factors that must be considered when changes are made.

Prof. Arthur J. McNair of Cornell University spoke on "Improved Techniques and Lower Costs." Professor McNair pointed out that if the surveying profession is not alert to new developments such as electronic techniques, statistical methods, and photogrammetric equipment, it will suddenly discover its field of operations scattered and gone.

An excellent Canadian motion picture, "Maps for the Army," was then shown. Lt. Col. James Long, of the Royal Canadian Engineers, introduced the film.

A panel discussion on "Popularizing Map Use" concluded this session. Walter G. Stoneman acted as moderator and the panel members were Fowler W. Barker, Frederick J. Doyle, Walker M. French, Arch C. Gerlach, Arthur Lundahl, Phil M. Miles, Clarence B. Odell, and Walter W. Ristow.

Robert H. Randall, Bureau of the Budget, presided over the final plenary session on Wednesday afternoon. John A. Walls, former president of Pennsylvania Water and Power Co., presented a paper, "What Surveying Means to Industry," in which he cited excellent cooperation between industry and government mapping agencies and advocated more Federal service at the local level.

A movie film showing how radar finds and tracks hurricanes highlighted the talk on "Locating Hurricanes by Radar," presented by Prof. Joseph Weil, Dean of the College of Engineering, University of Florida.

In a paper on "The Role of the Federal Agencies in Promoting Education in Surveying and Mapping," Prof. Milton O. Schmidt, of the University of Illinois, cited the need for closer liaison between Federal mapping agencies and engineering schools and called for a planned, continuous, long-range public-relations program between these two groups.

The final paper, a discussion of "International Cooperation in Cartography," was given by Dr. Te-Lou Tchang, Acting Chief, Cartographic Office, Department of Social Affairs, United Nations.

Technical Division Sessions

Business transacted at these sessions will be covered in the report of each technical division, to appear in a later issue.

CARTOGRAPHY DIVISION

Division Chairman Robert L. Moravetz presided over the Cartography Division meeting on Tuesday morning. The session was featured by a panel on "Plastic or Glass Engraving Versus Drafting." Panel members agreed that scribing may ultimately replace pen-and-ink drafting because of its great speed and the relative ease with which skill in the technique may be acquired. Charles F. Fuechsel was moderator of the panel. The panel members were Frank A. Clemens, A. A. Gioiosa, Samuel Sacks, H. W. Whitlock, and Archer M. Wilson.

CONTROL SURVEYS DIVISION

The first session of the Control Surveys Division was held on Monday afternoon, Chairman Benjamin E. Beavin, Sr., presiding. Lansing G. Simmons, U. S. Coast and Geodetic Survey, presented the first paper, "Spacing of Control for Local Use."

An estimate of the savings that can be realized in land surveying through the use of a State Coordinate System was given by Newell B. Snow, R. L. S., Buzzards Bay, Mass., in a paper entitled "Use of Control for Cadastral Surveys."

Thomas W. Shives, Anne Arundel County Sanitary Commission, Maryland, spoke on "Should Public Service Underground Structures Be Tied in to the Coordinate System." Mr. Shives advocated the establishment of coordinate values and vertical values on all underground lines so that public service groups working in the same area could more easily locate proposed new construction.

The second session of the Control Surveys Division, held on Wednesday morning, consisted of a panel on "The Contribution of Control to Economic Development." Chairman Beavin acted as moderator. The panel members were G. W. Herzog, Bernard H. Kock, Marshall S. Wright, and Floyd W. Hough.

EDUCATION DIVISION

The Education Division met on Wednesday morning with Prof. Lawrence Perez, chairman, presiding.

The chairman announced that a resolution expressing sympathy was being prepared and would be sent to the family of Prof. Harry Bouchard regarding his untimely death.

Professor Perez gave a short historical résumé pointing out the changes in education techniques that have taken place in the past couple of decades whereby continuing pressure has been brought to bear toward the reduction of surveying credits. He urged that steps to preserve the proper place of surveying in the curriculum of various institutions should be taken as opportunity occurs and not await slow-moving actions by committees or groups.

Prof. Russell C. Brinker, Virginia Polytechnic Institute, gave a brief report on his efforts of the past year to act as a sort of clearing house for the exchange or acquisition of surplus equipment and information regarding needs for summer camp instructors. He stated that he will carry on similar work during the coming season.

In his paper on "The Value of Maps in Education," Alfred C. Stiefel, U. S. Geological Survey, advocated the integration of maps into engineering courses so that students would become accustomed to using them.

A panel discussion followed on "Research in Surveying and Mapping Education." Prof. Arthur J. McNair, Cornell University, was moderator. The panel members were Prof. Frederick J. Doyle, Prof. Sumner B. Irish, David Landen, Alfred O. Quinn, and Dr. Raymond J. Seegar.

Prof. Harmer A. Weeden, Bucknell University, led a discussion on "Cartography Courses—Engineering or Geography Curriculum?"

INSTRUMENTS DIVISION

Division Chairman Carl W. Keuffel presided at the meeting of the Instruments Division on Tuesday morning. The session was devoted to a panel discussion on "Use of Surveying Methods and New Instruments for Industrial Application." The moderator was Prof. Philip Kissam of Princeton University. Panel members were Capt. O. S. Reading, U. S. Coast and Geodetic Survey, and Jack Steele, Farrand Optical Co.

The panel members told of some new and unusual applications of surveying techniques in manufacturing procedures, especially in the aircraft industry. A lively discussion from the floor followed the presentation by the panel members.

PROPERTY SURVEYS DIVISION

The first session of the Property Surveys Division was held on Tuesday morning with Division Chairman Ralph Moore Berry presiding.

Sol A. Bauer, Registered Engineer and Property Surveyor, Cleveland, Ohio, spoke on "The Surveyor's Handbook—Its Contents and Publication." Mr. Bauer reported on the progress made in assembling material for the handbook and the problems of determining its content. A constructive discussion from the floor followed Mr. Bauer's remarks.

In the absence of the author, Chairman Berry gave the highlights of a paper by J. Stuart Boyles, Registered Engineer and Land Surveyor, Houston, Tex., on the subject of "Surveying Problems in Texas." Several members added their comment from the floor on problems they had encountered similar to those described by Mr. Boyles.

The Division met again on Wednesday morning to hear two papers. William H. Moss, L. S., Washington, D. C., spoke on "Waste in Boundary Litigation and Preventative Measures." Mr. Moss cited a competent and exhaustive survey as the most important item in settling a boundary dispute.

In a paper entitled "The Surveyor in Court," William C. Wattles, L. S., California, pointed out that the surveyor is a fact finder and analyst who presents facts, applicable theories, and rules, but the rendering of a decision is the prerogative of the Court.

TOPOGRAPHY DIVISION

The first session of the Topography Division was held on Monday afternoon, Chairman Shirley V. Griffith presiding. Earle J. Fennell, U. S. Geological Survey, presented a paper, "Planning for National Map Coverage," in which he discussed the objectives of a national mapping program, the need for information on map requirements, and the time required for completing the project.

In a paper on "Topographic Maps in Highway Work," L. L. Funk, California Division of Highways, stressed the importance of topographic maps in highway location and design with particular emphasis on the advantage of photogrammetric methods for obtaining the maps.

At the second meeting of the Division, on Wednesday morning, Robert H. Lyddan, U. S. Geological Survey, spoke on "How Much Topo-

graphic Detail." Mr. Lyddan invited discussion on how many wells, springs, trails, and other details should be shown on topographic maps of the United States.

Cyrus G. Finley, Jr., Army Map Service, spoke on "The Look of Tomorrow's Topographic Maps." Mr. Finley predicted radical changes in the manner of presenting details on military maps, citing shaded relief, better use of colors, and three-dimensional plastic maps as likely fields of development.

Business Meeting

President Studds called the business meeting to order and announced that inasmuch as reports of the technical divisions would appear in the Journal, these reports would not be read at the meeting.

Benjamin E. Beavin, Sr., chairman of the Resolutions Committee, then presented four resolutions, all of which were adopted. These resolutions are printed in this issue under Congress News.

Capt. Frank S. Borden presented the report of the Membership Committee including the announcement of four winners of Membership Awards for outstanding work in recruiting members for the Congress (*See* Congress News).

Alfred C. Stiefel, chairman of the Public Relations Committee for 1952, and Murray Y. Poling, his successor, presented reports on the activities of that committee.

Executive Secretary Walter S. Dix presented his report, which is printed in this issue under Congress News.

Exhibits

Leading domestic and foreign manufacturers staged the most extensive and interesting exhibits ever displayed at a Congress convention. The exhibits included a wide variety of surveying and mapping equipment and supplies, and scientific instruments and machines. The great interest aroused by the exhibits was attested to by the crowds that flocked around the booths throughout the meeting. The list of exhibitors included the following firms:

Abrams Aerial Survey Corp., Lansing, Mich.
Aero Service Corp., Philadelphia, Pa.
Bathey Manufacturing Co., Plymouth, Mich.
Bausch & Lomb Optical Co., Rochester, N. Y.
C. L. Berger & Sons, Inc., New York, N. Y.
Charles Bruning Co., Inc., Teterboro, N. J.
Brunson Instrument Co., Kansas City, Mo.
Commercial Office Furniture Co., Washington, D. C.
Eugene Dietzgen Co., Washington, D. C.
Direct Reproduction Corp., Brooklyn, N. Y.
Friden Calculating Machine Co., Inc., Washington, D. C.
Geo-Optic Co., Inc., New York, N. Y.
W. & L. E. Gurley, Troy, N. Y.
Jarrell-Ash Co., Boston, Mass.
Keuffel & Esser Co., Hoboken, N. J.
Lufkin Rule Co., Saginaw, Mich.
Don A. Moler, Washington, D. C.
Monsen-Washington, Washington, D. C.
Motorola, Inc., Chicago, Ill.
Geo. F. Muth Co., Inc., Washington, D. C.
Nu-Way Co., Washington, D. C.
Paul Reinhart Co., Inc., New York, N. Y.
Rutherford Machinery Co., Long Island City, N. Y.
Trans-Global Co., New York, N. Y.
Wallace & Tiernan Products, Belleville, N. J.
David White Co., Milwaukee, Wis.
Henry Wild Surveying Instruments Supply Company of America, Inc., Brooklyn, N. Y.
Williams & Heintz Lithograph Corp., Washington, D. C.

Social Activities, Ladies Program

Formal social activities began on the opening day with a luncheon at which Dr. Andre Simonpietri introduced delegates and members from a dozen foreign nations.

Events for the ladies were well planned, making a full and attractive program for visiting wives, as well as those in the Washington area. Members of the local committee, ably headed by Mrs. Raymond W. Bellamy, were on hand to greet visitors and to advise them of the various features arranged for their entertainment. Their first general gathering was at a tea held in the Louis Seize Room. This was a get-acquainted affair including an interesting talk by Mrs. Alfred Stiefel on her art of writing and illustrating children's books. This was followed by music presented by a talented young pianist, after which tea was served. In the evening of this same day the wives joined their husbands in several hours of "Social Reconnaissance" at

which old friends were greeted and new ones made.

A luncheon, sponsored by Senator Martin of Pennsylvania, was held for the ladies on Tuesday in the beautiful District of Columbia Committee Room in the U. S. Capitol. The room is embellished with paintings by Constantino Brumidi who is responsible for most of the decorative paintings in the Captiol. A talk on this artist was given by Mrs. Myrtle Cheney Murdoch, author of a book on the life of Brumidi. The group was greeted by both Senator Martin and Congressman Small from Maryland.

On Tuesday evening the annual Congress dinner was held at the Shoreham, presided over by our competent General Chairman, Murray Y. Poling. Presentations revealing some outstanding talent within the membership were supplemented by professional acts engaged for the occasion. Singing, dancing, mind reading, and impersonations featured this part of the program. All of the entertainment was received most enthusiastically by the more than three hundred guests in attendance.

Wednesday was a full, but enjoyable, day for the ladies, featured by a tour of the Maryland countryside by bus. Included was the Maryland Day Convocation at the University of Maryland, where a colorful and interesting program was given. Afterward Dr. H. C. Byrd, president of the university, was host at luncheon in the pleasant Terrapin Room. This was followed by a bus trip over the campus with a stop to visit the new chapel. Leaving the university, tours were made of some of the historic buildings along the way, including Roxboro Inn and the stately Calvert Mansion. Competent guides explained interesting features of these landmarks.

The ladies were then taken to the very attractive home of Commissioner and Mrs. Bellamy, where, in spite of rain, the display of spring flowers was enjoyed from the windows of the residence. Tea was graciously served by ladies dressed in Colonial fashion.

The annual dance was held in the evening at the Shoreham Hotel, thus completing a program that left both the visiting ladies, and those of the Washington area, talking hopefully of "next year."

Well-Deserved Credit to Chairman Poling

Anyone who has participated in the organization of an annual meeting such as our Thirteenth knows that it is a man-sized job. General Chairman Poling and the many members of the committees that made the meeting run smoothly did an outstanding job. They richly deserve the gratitude officially expressed in the resolution of thanks adopted at the business meeting.

MORRIS M. THOMPSON

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Inventory of Map Library Resources to be Published

IN COOPERATION with the Special Libraries Association, the Library of Congress is preparing an inventory of map library resources of the United States and Canada. This volume will supplement the reference work entitled "Special Library Resources."

Early in February questionnaires were sent to more than 5,000 libraries, and replies have been received from about 1,100 librarians. All libraries which report atlas and map collections suitable for entry in the publication will be listed. The project is under the direction of Marie C. Goodman of the Library of Congress, Chairman of the Map Resource Committee of the Special Libraries Association.

Information to be published in this volume on map library resources includes the location of the library; the map library staff; the size of the collection; areas of coverage; subjects of specialization such as agriculture, geology, city planning, meteorology, transportation, etc.; groups served, such as students, faculty, the public; and library facilities such as catalogs, reading rooms, reproduction facilities, exchange, inter-library loans, and publications. This compilation will fill a great need for information on map collections which are available to serve the increasingly map-conscious American citizen. Publication of this volume is expected in the Fall of 1953.

Opening Remarks

By PRESIDENT R. F. A. STUDDS
REAR ADMIRAL, U. S. COAST AND GEODETIC SURVEY

AS President of the American Congress on Surveying and Mapping, I declare the Thirteenth Annual Meeting officially open. In behalf of the officers and Board of Directors, I extend heartiest greetings to all of you and welcome you to this 3-day meeting. This is my first opportunity to address you since my election to the presidency last June. I am extremely grateful to all of you for having reposed in me the confidence of leading the Congress during 1953.

The General Chairman of this meeting has suggested that I say something about the Congress—what it is, what it is doing, and what its outlook is for the future. I believe this to be a good idea; for in the hustle and bustle that usually accompanies an Annual Meeting and in the anxiety to hear the many excellent papers that are usually presented, we often lose sight of what goes on behind the scenes in the day-by-day workings of the Congress—in the Executive Secretary's office, in the Editor's office, in the technical divisions, and in the committees.

The American Congress on Surveying and Mapping has had a remarkable growth since its inception in 1941. Launched on the eve of World War II, it was beset during its first 5 years not only with the problems and difficulties that usually accompany a new organization, but it was actually faced with survival, because many of the guiding spirits of the organization had either entered the Armed Services or were engaged on the home front in high priority work. Notwithstanding these handicaps, the real foundation for the Congress was laid during these 5 trying years. I think the Congress owes a debt of gratitude to the few individuals who took the reins in hand at a critical time and by their zeal and devotion paved the way for the ever-increasing accomplishments that followed.

Measured by normal standards, the Congress is still very much in its infancy. But in spite of its youth, it has achieved gratifying recognition, both nationally and internationally. We are a constituent member of the National Research Council; and we have been represented at meetings of the Pan American Institute of Geography and History, the United Nations, the Biennial Conference of Surveyors of the United Kingdom, and the Canadian Institute of Surveying and Photogrammetry.

Another encouraging indication is the varied composition of our membership. We started out to build on a broad base on the theory that that is the best way to contribute to public education in the use of surveys and maps—one of the basic aims of the Congress. We are gradually fulfilling that objective. Broadly speaking, our roster includes about an even distribution between the Federal and the non-Federal service. Within this framework there are representatives from all branches of surveying and mapping (including the educators in these fields), as well as from such related fields as geography, geology, engineering, instrument manufacture, and title insurance. Recently, we have received applications from such divergent interests as a seismologist in a geophysical company and a foreman in a steel company. This is of interest because it points up the great potential which is ours to capitalize. The approximately 3,200 members which we now have could easily be doubled within the next few years. A large membership is, of course, not an end in itself. But it is a necessary means to a realization of the broad aims on which the Congress is predicated.

Other healthy organizational signs are the fact that every State in the Union is now represented in the Congress, as well as all our possessions; and the fact that we have in the neighborhood of 260 institutional and library members, distributed among Federal, State, county, and city agencies; colleges and universities; and libraries and individual memberships in 38 foreign countries. So that the Congress actually reaches a far

Presented at the Thirteenth Annual Meeting, American Congress on Surveying and Mapping, Washington, D. C., March 23–25, 1953.

greater number than the membership figure would indicate.

Under the impetus of my predecessors in office, the Congress has also advanced in the scope of its activities. We now have 6 active Technical Divisions, comprising Cartography, Control Surveys, Education, Instruments, Property Surveys, and Topography. These divisions are the heartbeat of the Congress. As their activities increase, the Congress will grow in stature. That they are producing information helpful and necessary to the profession is evidenced by the many inquiries that are being received by the division chairmen from members and non-members, in this country and abroad, seeking technical information on new developments in methods and equipment. The Report of the Special Committee on Cartographic Research and Development, which was published in our Journal last year, elicited inquiries from a commercial map producer in this country, an instrument manufacturer, and a foreign concern. The Congress is happy to make such services available to the surveying and mapping profession.

Besides these technical divisions, we have nine standing committees that carry on the business of the Congress. A Map Use Committee is developing a program for disseminating information on the use and value of maps; another committee is working on a comprehensive manual on property surveying; and a third is studying the advisability of issuing compilations of Journal articles in specialized fields. Recently, a Professional Status Committee was created to formulate a long-term policy for the profession, so that the importance of surveying and mapping to the economic welfare of the country will be fully recognized. This should bring about a better understanding and appreciation of the status of surveyors and mappers in relation to other technical professions.

I don't want to overlook our Journal which can certainly be counted on the credit side of the ledger. We can all take justifiable pride in the fact that it has received a great deal of acclaim, both nationally and internationally. As the principal expression of the surveying and mapping profession in this country, it is looked upon as authoritative source material for the latest developments in instrumentation and techniques. Authors and text writers are continually quoting from its pages and many requests are received for permission to reprint material.

Financially, we are in a far healthier position than at any time in our history. But there is a "horn" on that statement that should not go unnoticed. We have no paid officers or employees. All work of the Congress is conducted on a completely voluntary basis. In the formative years of the Congress this was a must, although it imposed a considerable burden on a few individuals. But having passed the pump-priming stage, it seems to me we should begin looking to the day when the Congress can stand on its own footing. Opening the pages of the Journal to commercial advertising, begun during the past year, is only part of the answer. It is by no means the whole answer. This is a matter to which the Board of Direction should give serious consideration at an early date.

On every level, therefore, I feel the Congress is making commendable progress. Slowly, but with assurance, we are expanding our activities to advance the sciences of surveying and mapping in furtherance of the public welfare and in the interests of both those who use maps and surveys and those who make them.

I take this opportunity to express my appreciation to those members of the Congress who have willingly accepted a term of duty for the coming year (whether as officers, directors, or committeemen), so that the operation of the Congress, both in its administrative and technical fields, may continue without interruption. To those members whose work has terminated, I express the sincere appreciation of the Congress for their unselfish and distinctive service. And to all of you I extend my best wishes for an enjoyable and beneficial annual meeting. It is my hope that out of your deliberations and discussions, in both the plenary and technical sessions, there will emerge a new appreciation of the great responsibility that is ours to carry forward the work of the Congress to new and ever-widening horizons.

Address of Welcome

By THE HONORABLE SINCLAIR WEEKS
SECRETARY OF COMMERCE

I AM PLEASED to accept your kind invitation to give the welcoming address at this distinguished gathering. Among your famous predecessors were George Washington and Abraham Lincoln, both of whom were surveyors. Perhaps that is the secret of their later success.

Although I am not an engineer, surveyor, map maker, or professor, as are so many members of this group, I have a close bond of interest with you.

As Secretary of Commerce I have under my administrative direction a number of agencies whose work approaches your field. Among these are the Civil Aeronautics Administration, Maritime Administration, Bureau of Public Roads, National Bureau of Standards, Weather Bureau, and Coast and Geodetic Survey, which as most of you know is one of the oldest—if not the oldest—mapping bureaus in the Federal Government.

One of the great concerns of the Department of Commerce is the national welfare. That welfare can be promoted through a broad fact-finding program which patiently gathers technical and other information in advance so that business and industry can inventory and evaluate the background, current situation, and prospects before embarking on an undertaking.

In the Department of Commerce, we are surveying our whole program of collecting and publishing information. We want to be sure that our fact-gathering and fact-disseminating do the modern job which the modern public desires and needs. The same thinking is applied to all our operations, including those in which you have a particular interest.

Specific programs under Secretaries of Commerce, Cortelyou, Strauss, Redfield, Hoover, Jones, and others may have been excellent for their particular day. These functions and programs are being re-evaluated in the light of radically changed conditions.

We want to feel certain that these services are valuable in this period of world tension and of heavy burdens on taxpayers. But we are just as earnest in seeking to discover new functions or expanding old ones that attack current problems in the tempo of 1953.

We want to do the best job possible within our means to give industry and the public the most accurate, timely information for sound judgments, plans, and operations in this world of today and tomorrow. I know that this approach also is the approach of public and private surveyors, mappers, and chart-makers, as well as educators and the manufacturers of scientific instruments.

Although we belong to the same lodge, I do not, of course, pose as a technical expert in the intricacies of your science. Plenty of authorities are here at this Congress to delve into the strictly professional side and to present their reasons for believing that engineering surveys and maps are essential to economic planning—the theme of this meeting.

I speak as a representative of the new Administration and as a public official with a business background.

This new Administration has confidence in the power of responsible private enterprise to advance society along the road to prosperity and progress.

We believe that the Department of Commerce—all of its agencies—should do constructive things which foster, promote, and develop commerce and industry. For by giving industry accurate facts and the en-

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couragement and the opportunity to succeed, all segments of society will share in the rewards of that success.

Business is the friend of science and engineering. Business recognizes the value of science. In countless ways business employs science to promote business interests. Business is always looking at research laboratories and the Patent Office in quest of new ideas, new products, new ways of using old products.

Business, which has investment money at stake and hopes for profits, greatly values accurate plans, blueprints, appraisals, surveys, charts, and maps as one means of making wise decisions as to future actions.

When businessmen are called into government, they continue their habitual respect for the scientific approach to modern economic conditions.

It is in its own self-interest for science to support those in national, state, and municipal government who are seeking to eliminate confusion, overlapping, duplication, and extravagance. For bedlam and waste squander funds which otherwise might be used for scientific services or be left in the taxpayers' pocket.

I feel at home among you, for one of your functions in both government and in private enterprise is to prevent the waste of time and money that comes from failure to keep a keen eye on the ground.

I do not believe in a "planned economy," as the term is used by socialistic-minded theorists. Such regimentation ruins initiative. It bars the success incentive from life. It turns men and women into dull robots. It puts Marx and Malenkov above Franklin, Ford, and Edison. It takes the zip out of freedom.

No, I do *not* believe in a so-called "planned economy." But I most certainly *do* believe in government and private industry making plans to do their job. That means counting the costs in advance. That means finding out the direction in which we are going before stepping on the gas.

That means surveying and mapping—your life endeavor—before moving ahead with a project. Such exploration not only prevents the undertaking of unwise projects but also finds how to do the best job possible under existing conditions.

A large share of the tax bill for waste of public funds at every level of government is caused by the failure of some official to look before he leaped—dragging the taxpayer down with him. Moreover, many an improvident private industry management gets hit by a tremendous bill for unnecessary expenditures because someone failed to check all the facts and evaluate the necessary basic data before starting an expensive operation.

I am told by those who have probed the subject that a certain mid-western city each year spends a round million dollars on litigation of property boundaries. Registered land surveyors and engineers maintain that this wasteful expenditure of time and money could be drastically reduced by the use of modern survey methods.

In another city an owner failed to check his boundaries and erected a nine-story apartment house that infringed one-tenth of a foot on his neighbor's land. The pair fell to fighting like feuding mountaineers.

The apartment owner refused to pay damages to the next-door owner because of a controversy over the original property description. The court finally declared that the building was over the line ard ordered the owner to pay up. Instead, he hired workmen to chisel one-tenth of a foot of bricks along the entire height of the building.

This was not the end of the neighborhood row, however. The landowner sued the building owner for trespassing on his property with the scaffold used by the workmen in chiseling. Had the landlord hired one of you experts before he built his house, the two neighbors might still be buddies.

Careless planning, resulting in wasted funds, causes a share of the criticism of some past performances in the Point Four Program.

In a Caribbean country a reclamation project was agreed upon. When the question of boundary lines of the area to be flooded was considered, it was learned that

many of the lines—as described in old French land grants and other records—were difficult to determine. This delayed project operations and necessitated such an expenditure for litigation that expenses ran in excess of the government funds available.

Haste made waste. Advance control surveys and the use of map information would have furnished data as a base for property descriptions.

A different approach was followed in Liberia. Funds were promised for development. Lack of maps was recognized. A contract for mapping was made with a private engineering company. Later, when construction is undertaken, the project engineers will know the exact nature of the terrain. Thus, waste will be avoided and a better job will be done.

It seems to me that this scientific Congress can well serve its own members' pocketbook and the public if it continually emphasizes the money-saving possibilities of adequate surveys to real estate brokers, title insurance firms, property owners, and others.

The public should be educated into an appreciation of foresight. An owner should be sure of his ground before he calls in the steam shovel to dig a cellar.

Hydroelectric power, superhighways, flood control, and other construction projects, obviously, are better handled when adequate surveys, maps, and charts are at hand. Advance understanding is needed as much in State and municipal public works as in the study of great projects like the Missouri and Columbia River Basins.

The finding of new natural resources and the proper development of existing ones are linked with adequate surveys. The need for more detailed knowledge of our geological resources is apparent in the current intensive search for minerals required in atomic energy. The coming of jet airplanes, guided missiles, and snorkel submarines presents new areas for surveying and charting.

I take this opportunity to pay tribute to the long line of able scientists, engineers, and others, both in and out of the Federal Government, who—often despite hardships and danger—have added greatly to the sum of human knowledge.

Their efforts have brought greater safety, profits, scope, and progress to the shipping industry, fishing fleets, yachtsmen, port authorities, oil explorers, aviators, reclamation engineers, transportation constructors, urban development planners, and many others.

To all of you attending this Congress, I extend an invitation to visit the agencies within the Department of Commerce to find out new ways in which we stand ready to serve you.

You all know the famous story of the wise and foolish builders. On made no effort to learn in advance about the features of the ground on which he would rear his home. So he discovered he had built upon sand.

"And," say the Scriptures, "the rain descended, and the floods came, and the winds blew and beat upon that house; and it fell; and great was the fall of it."

But the wise man called in the surveyors and map makers. He studied his ground. He knew what he had under him. He built upon a rock. When nature flung its hurricanes at that house, it stood firm because "it was founded upon a rock."

Your mission, my friends, is to teach industry and government the lesson in every modern version of the house that was built upon sand and the house that was founded upon rock. Your task is to convince society of the value of preparing basic data before deciding to embark upon a project.

Because of the composition of your organization, you are in an excellent position to further that partnership of which President Eisenhower spoke in his State of the Union Message—a "partnership of the States and local communities, private citizens, and the Federal Government, all working together" in a combined effort to advance a sound conservation program in the interest of our Nation's welfare.

A few years ago Kenneth Mason, an English geographer, said, "I have hinted that the world is discovered, but I doubt

whether a hundredth part of the land surface of the globe is surveyed in sufficient detail for modern requirements. If the pioneer's day is nearly over, the specialist-explorer's dawn is breaking."

You have done much, but there is much yet to be done. May your efforts be crowned with success.

Old as your science is, you are men of the future.

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New Editions of Lake Survey Charts

THE United States Lake Survey of the Corps of Engineers, U. S. Army, has announced the release of new editions of five charts. These include two St. Lawrence River charts—No. 11, St. Lawrence River, St. Regis, Que., to Richards Landing, N. Y., and No. 12, St. Lawrence River, Richards Landing to Leishman Pt., N. Y., both at the scale of 1:30,000; two Lake Erie charts—No. 37, Coast Chart, Port Clinton, Ohio, and Colchester, Ont., to mouth of Detroit River, at the scale of 1:80,000 with an inset of Port Clinton at 1:10,000, and No. 374, Toledo Harbor, Ohio, Maumee Bay and Lower Maumee River, at the scale of 1:20,000 with an inset of entrance channel to harbor at 1:40,000; and one Lake Champlain chart—No. 175, Burlington Harbor, Vt., at the scale of 1:10,000.

The edition date of all five charts is January 1953.

Copies of the above charts may be procured from the U. S. Lake Survey, 630 Federal Bldg., Detroit 26, Mich. The cost is 75 cents each and payment in advance is required with the order, by P. O. money order or draft, payable to the Treasurer of the United States. Shipments are made promptly, postage free.

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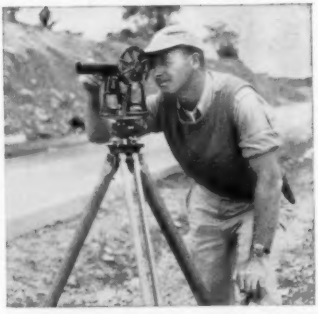

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Impasse in Surveying Education

By MILTON O. SCHMIDT

ASSOCIATE PROFESSOR OF CIVIL ENGINEERING, UNIVERSITY OF ILLINOIS

PROFESSIONAL surveying education in America faces a veritable impasse today. Disparaged by those teaching in other areas of civil engineering and embarrassed by the restrictions of emasculated courses, surveying and mapping instruction in our civil engineering schools faces a critical test in the years immediately ahead.

The following remarks may be considered as pertinent both to the Control Surveys and Education Divisions of the Congress since their functions are closely associated with the difficult situation facing us in this phase of civil engineering education today. Let me briefly sketch this plight for you.

Many instructors engaged in the teaching of surveying lack a sound professional base on which to establish academic prestige. It is not strange that surveying teachers are often considered to exemplify a class of workers performing the stable-duty chores of the civil engineering profession. Many of us hardly ever rise above the subprofessional stratum of surveying which is formidably wide and deep. The continued attrition of surveying courses and the delegation of instructional tasks to graduate students in structural engineering and other iridescent fields has been responsible for the progressive deterioration of what was once high teaching morale among those in surveying education.

Programs in surveying and mapping for future professional engineers frequently do not extend beyond the manipulative aspects and rudimentary practices of this science. The instruction is confined to basic procedures such as taping, differential leveling, and prolonging a straight line; and the ineptness and prosaic attitude of the graduate-student instructor, or the lassitude of the mature teacher who is resigned to his fate makes for docile, adulterated and mediocre instruction. Perhaps a good technician is trained but the future civil engineer is not properly introduced to the potentialities of survey and map data.

Because of his continued association with a science whose importance is not adequately demonstrated, the surveying teacher soon finds himself in a kind of technological Nirvana in which he generally becomes oblivious to external reality. Lack of academic and professional recognition kills ambition and soon the intellectual abilities undergo atrophy. Occasionally, if it is not too late, the more intelligent teacher will depart for a more fruitful though less protected field of employment. There is this thing about academic tenure which I would like to mention parenthetically to those who have never resided in our ivory towers. Once he has attained professorial rank, it is possible for the greatest dullard to continue on the payroll unless he is successfully convicted of some heinous crime. Somebody once said a professor had to be nabbed in the commission of an act of deepest moral turpitude, with the action attested by three witnesses, before he could be fired.

For the civil engineering student, plane surveying is only the preface to the study of various other kinds of surveying including those involving the execution of basic horizontal and vertical control. Although it is true that in most schools an introduction to such surveys is offered, it is doubtful whether the fullest possible opportunity is utilized to stress the enduring value of well executed and carefully documented surveys of this type. Phlegmatic instructors fail to carry the concept of the whole surveying mission to the student. All too frequently, therefore, the student obtains little more

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than a vague notion and a shallow appreciation of the value of maps and survey data in civil engineering practice.

In some instances, the extension of local control surveys by civil engineering students may partially solve the dilemma facing surveying teachers. Such surveys provide engineering data which, when properly processed and disseminated, can become highly useful to the community, State, and Nation. The execution of control surveys assists the teacher in securing professional recognition and offers convincing training to the students. However, the contemplation of the benefits of such a program must be accompanied by a forthright appraisal of some difficulties. Let me briefly outline the circumstances under which such local control surveys by engineering students are feasible. This will also indicate the lines of action which can be taken by most civil engineering departments to publicize the value of control data to practicing engineers as well as students. I am at once reminded of the C. W. A. local control surveys that were executed in many States during the early 1930's as a measure of unemployment relief. Like that noble experiment that was terminated by the 21st amendment, the C. W. A. program had best be relegated to the limbo of forgotten engineering enterprises. Lack of planning and unfamiliarity with the fundamental operations for executing surveys of this nature made it a project of little eminence. In a similar connection I have recently heard of volumes of triangulation, traverse, and leveling data of W. P. A. vintage but of good quality which are buried in the city engineer's files in a large, midwestern municipality. Here the material remains—unsorted, unclassified, and unused—although the cost of obtaining such information today would be considerable. Since the value of control data is in direct proportion to its use, a genuine service would be rendered to the engineering profession if the schools would not only undertake a program of direct expansion of the national control network but also assume a strong role in showing how such survey data can be utilized.

Any plan for the extension of local control surveys by engineering students in and around the campus community is beset by a very real difficulty—the inability to secure a time schedule which is adequate and sufficiently continuous to support this kind of activity. On the Urbana-Champaign campus of the University of Illinois we have not found it practicable to utilize the very limited classroom time of our civil engineering students to perform control surveys. However, we are adopting a uniform control framework for all future campus topographic surveys instead of the multiplicity of coordinate systems which inexperienced instructors have developed over a long span of years. All horizontal control data is being calculated on the Illinois Transverse Mercator System and systematically catalogued on 4- and 6-inch cards. We prefer to use North and East to prefix our coordinate values instead of y and x and we use bearings instead of azimuths. Bronze tablets of distinctive design set in a concrete post have been used at our surveying camp for several summers and it is planned to monument the more important campus points with them.

We have also been executing lines of precise levels over the 100 or more bench marks of the university's physical plant department. These extend over an area of a few square miles and offer the basic vertical control for any engineering projects undertaken by the university. The task of running these levels has been performed by graduate students only, since their study programs permit far more latitude for work of this type than do the undergraduate schedules. For the most part, however, control surveys can be most effectively executed at the summer camp although even there certain limitations become obvious.

At the Ohio State University camp, precise horizontal and vertical control surveys have been extended in the Zaleski State Forest. This is part of a cooperative program with the State Division of Forestry to provide topographic maps for an area that will ultimately encompass some 100 square miles. At the Illinois summer surveying

camp in northern Minnesota we have made a beginning in expanding the network of fundamental control. This will serve primarily the needs of a mapping program which, it is hoped, will extend considerably beyond the immediate confines of the camp itself. However, because of the economic character of the surrounding region which is largely submarginal farm land and second-growth forest, little use will be made of this survey data by the engineering profession.

On the local campus a graduate surveying program would afford a genuine opportunity for a number of developments. The student would obtain a keener insight into the nature of engineering surveys, a broader and more mature viewpoint regarding the function of surveying, and a superior type of field and office training. To the faculty such an activity would serve both as excellent refresher training and as new experience in the conduct of higher-type surveys. For the school, it would provide favorable publicity and further justification of the educational role. Furthermore, the possibility of experimenting with new survey methods, such as subtense traversing, offers an attractive inducement to perform these surveys. A most commendable project would be the establishment of a standard of length for tape comparison purposes in the basement of the local city hall or courthouse.

If conditions favor the extension of the horizontal control network, only state-wide or possibly tangent-plane coordinates should be employed. The field and computation procedures associated with plane coordinates are easily learned by the student as well as by the practicing civil engineer and surveyor and afford decided advantages over the use of geodetic coordinates.

If the conditions either at the summer surveying camp or in the vicinity of the local campus do not favor or make feasible the actual extension of control, it is still possible for the civil engineering school to encourage the wider use of fundamental control data. One suggestion is to initiate the compilation of data on reputable bench marks of all surveying agencies in the school community, city, or county, and to refer their elevations to the latest mean sea level datum. This compilation could be prefaced by a brief résumé of the history of leveling operations in the immediate area and include a good base map on which are depicted the various bench marks. If there is a pronounced reluctance to permit the publication of bench mark elevations of some organizations and of city engineer departments on the sea level datum, a chart can be prepared showing the elevation differences between the several datum planes and the method of making interconversions. In a similar manner, a map depicting monumented stations of known horizontal position can be prepared. The compilation and portrayal of such data in attractive bulletin form for municipal or county use will help to strengthen respect for the work of the Federal and State surveying and mapping agencies and the surveying divisions of our civil engineering schools.

Finally, alert, intelligent, and vocal leadership is needed in surveying education. We look to you in the American Congress on Surveying and Mapping for your continued encouragement and good counsel.

AERO SERVICE CORPORATION ESTABLISHES SUBSIDIARY

The Aero Service Corporation of Philadelphia has announced the establishment of a subsidiary company at Salt Lake City, Utah, to serve expanding aerial mapping requirements in the West. The subsidiary, Aero Service Corporation (Western), will compile topographic maps and photo-maps for oil and mining companies located in the West, and will produce maps for highways, cities, flood control, irrigation studies, and other engineering uses.

Aero Service Corporation (Western) will employ the same mapping methods and equipment as the parent company. The Salt Lake City location will bring better service for Aero's Western clients.

Expert or Specialist?

By HUGH C. MITCHELL

"AS AN EXPERT, what is your opinion in this matter?" was the question asked of one of the men in conference. He replied, "I am no expert, but if you wish my opinion as a specialist, I shall be glad to give it." Thus was emphasized a very definite distinction between the two terms.

The dictionary defines a *specialist* as a person who has devoted himself to the study of a particular branch of art or science, and thereby has acquired a particular or special knowledge of the subject. The *expert* is defined as a person who has been taught by use, practice, and experience. The expert is the artisan. One may become an expert piano player, without ever becoming an artist. One may be an expert in surgical operations—the art of surgery; and in any number of manual skills, physical operations, maneuvers, processes, and calculations. But in philosophy, for example, which is a science, a philosopher is necessarily a specialist of knowledge in that field. George Washington was a specialist in statecraft, an expert in warfare. This might also be said of General MacArthur, being careful not to confuse statecraft with politics.

The specialist is a modest person who says, "I have studied the subject carefully and from what I have learned, I have formed a certain opinion. Further study may reveal information that may modify my present opinion to some extent." The expert says, "I have been, and seen, and done, and I know the answer." And likely as not, he will be contradicted by another expert who also has "been and seen and done," but probably has been along another path, seen from a different viewpoint, and done with other tools. Both may be wrong. When experts disagree, as they often do, it is necessary to consult a specialist on the subject, and, from the details of the conflicting experiences viewed in the light of thorough study upon the subject, endeavor to find out the true answer.

Being an expert is a difficult role to play—in any field. To maintain a reputation as an expert is no easy matter: it's a competitive rating. The specialist is not competitive: his ears, and eyes, and his mind, are open. And even when retired from active service, the specialist may continue as an interested inquirer and thereby maintain, and even improve, his status as a specialist.

In the progressive life of our nation we have need of both the expert and the specialist. It is when we find the two combined in one person that we have one of the most useful of our citizens—the engineer.

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New Pen Cleaning Aid

HIGGINS INK CO., INC., makers of Higgins American India Ink, has released a new product which promises to be of interest to all users of drawing inks. The item is a straight-sided 6-ounce jar of Higgins Pen Cleaner equipped with a screw cap and containing a special plastic strainer in the bottom of the jar. Affixed to the center of the strainer is a rod which projects above the level of the liquid. This rod enables the user to raise the strainer and remove pens, etc., without fishing around in the jar. Small items such as Wrico and Leroy pen parts, airbrush parts, Speedball pens, and drafting instruments may thus be dropped without concern into the jar of Higgins Pen Cleaner. When instruments are clean, they are removed by lifting the plastic strainer.

The Graduation of Precise Circles

By BENJAMIN L. PAGE
PHYSICIST, NATIONAL BUREAU OF STANDARDS

A LARGE NUMBER of precise circles for theodolites have been graduated at the National Bureau of Standards in recent years. It seems desirable to make certain details of technique available.

In graduating precise circles, that is, circles that do not have errors in excess of 2 seconds of arc, it is essential to have: first, a dividing engine capable of graduating a circle to this degree of accuracy; second, ruling points so ground and polished that they will cut lines with clean sharp edges and of the proper width and depth; third, circle blanks properly designed, machined, polished, and stabilized by proper heat treatment; and fourth, a complete understanding of each of the many detailed operations which must be performed by the operator in order to obtain a circle that can be called precise.

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THE DIVIDING ENGINE

The dividing engine (figs. 1 and 2) used at the National Bureau of Standards was obtained from the Société Genevoise d'Instruments de Physique, of Geneva, Switzerland. This instrument, which is fully automatic in operation, is located in a constant temperature room in the basement of one of the buildings. In order for the engine to be free from any serious vibrations it is mounted on a thick block of concrete, about 1 meter on a side, the upper surface of which is flush with the floor of the room. The block is insulated from the surrounding ground and concrete by a 2-inch layer of cork board. The temperature at which the circles are ruled is between 20° and 25° C. and does not vary by more than $\frac{1}{2}$° during the actual ruling of a circle. The

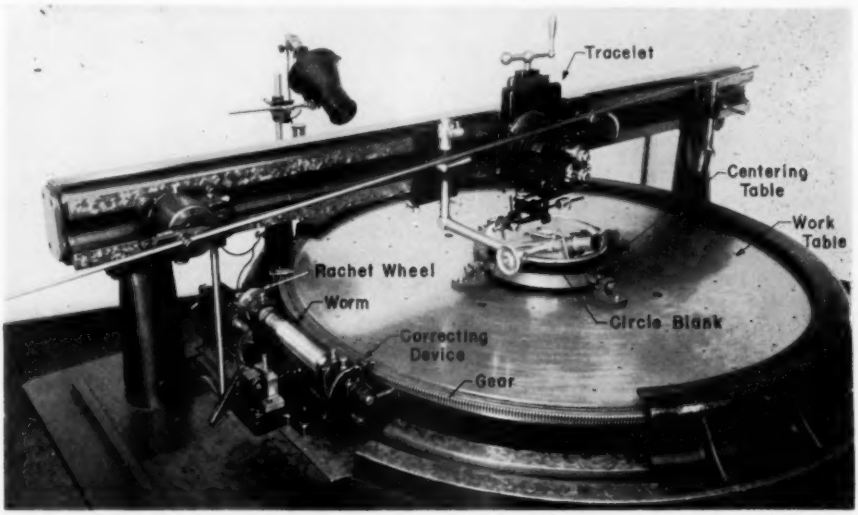

FIGURE 1.—Dividing engine (overhead view).

main elements of this engine are the worm, the worktable and gear, the main bearing, the correcting device, the ratchet wheel, and the tracelet.

The Worm.—The cylindrical worm (fig. 3) is a special hardened steel screw, ground and lapped under actual working conditions, which is constantly held, by a spring, in positive engagement with the gear teeth on the worktable. The worm can be easily disengaged by a lever, whereupon the table can be rotated by hand when centering and leveling a circle blank prior to graduation. Special care must always be taken when engaging the worm in the gear, to avoid injury to either.

The Worktable and Gear.—The worktable (fig. 3) which is about 40 inches in diameter, made of cast iron, and mounted on a conical spindle, revolves in its conical journals. The 720 teeth in the worktable periphery are accurately cut and lapped. They should, however, not be lapped so perfectly that they wring together with the

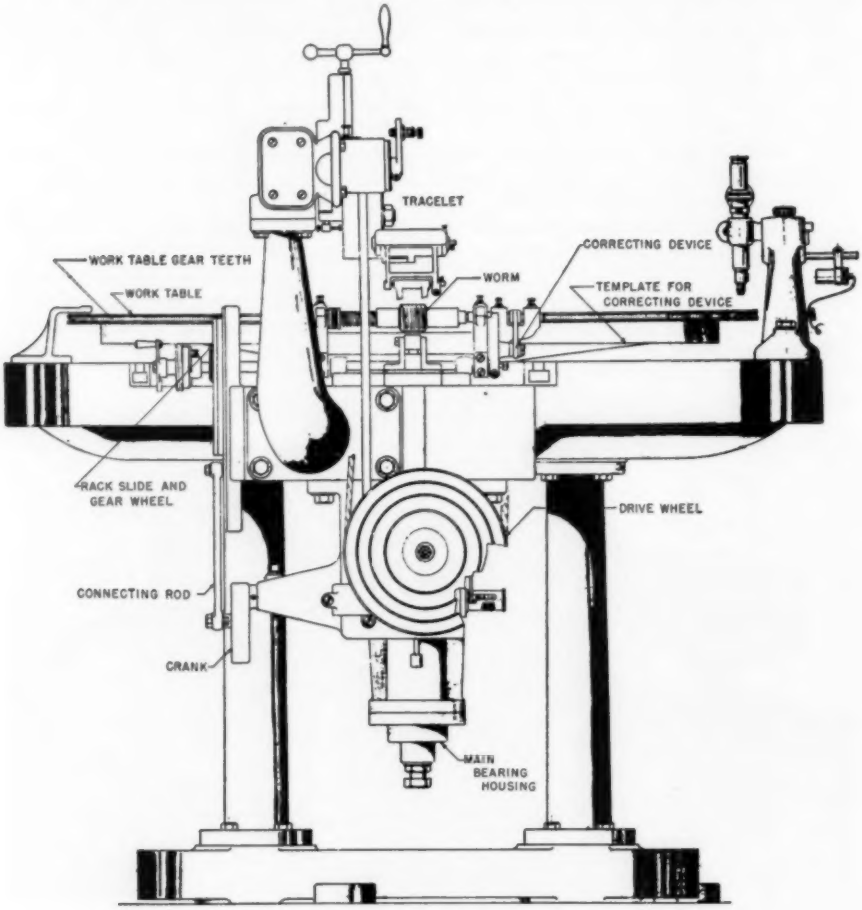

FIGURE 2.—Dividing engine (side view).

worm, causing them to lock together. If there is a tendency toward binding, the worm clearance must be slightly increased so as to insure a smooth and even movement between worm and gear.

The Main Bearing.—The main spindle (fig. 4) is of the conical type, with the conical journals near both the upper and lower ends of the spindle, and the axial thrust bearing at the lower end. The tightness of this spindle in its conical journals can be adjusted by means of a thrust screw, by either raising or lowering the spindle and worktable assembly.

The Correcting Device.—The effect of the small variations of pitch between consecutive teeth of the gear is reproduced on a large scale on the circular steel template (fig. 5) attached to the underside of the table. These small variations are automatically compensated for by the corresponding positive and negative axial movements imparted to the worm through a lever carrying a roller which follows the profile of the template. This complete assembly is known as the correcting device.

The Ratchet Wheel.—The ratchet wheel (fig. 6) imparts to the worktable, through the worm, a rotary displacement (in one direction) corresponding to the angular interval required for any particular circle being graduated. The periodic rotary movement of the worm in one direction is obtained by the use of the ratchet wheel affixed to the end of the worm shaft. This is driven by a crank, connecting rod, rack slide, and gear wheel. The intermittent rotary movement of the worm is limited by an adjustable stop and a fixed stop. The maximum angular interval automatically obtainable is 1°.

The Tracelet.—The ruling mechanism or tracelet (fig. 7) is mounted on a slide which can be moved along the crossrail ways to any desired position for ruling a circle of any radius up to approximately 20 inches. The lengths of the graduation lines are limited by two abutment screws which contact two disks, one of which is plane and the other having an appropriate number of notches. These disks are rotated by a ratchet wheel. In some cases two notched

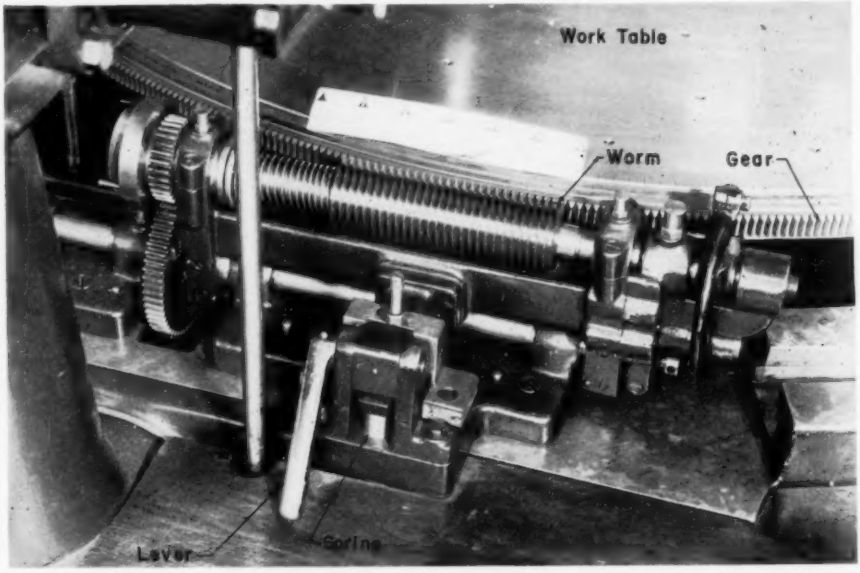

FIGURE 3.—Worm.

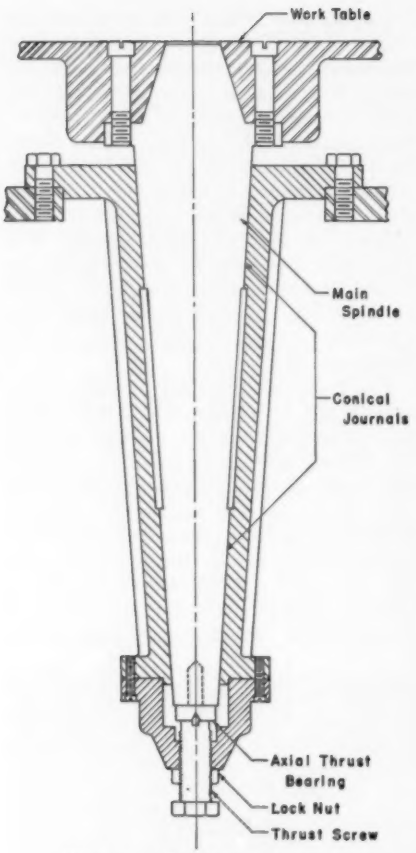

FIGURE 4.—Detail of main bearing.

disks are used, when required by the type of graduation desired. The variations in the lengths of the lines are dependent on the setting of screws fitted into the notches of the disk or disks as the case may be.

THE RULING POINTS

In graduating precise circles, specially shaped diamond tools (fig. 8) are used. The crystals from which they are made are high-grade commercial diamonds properly mounted in the end of a shank of steel, or other suitable material, about 3/16 inch square and about 2 inches in length. The actual size of the shank depends on the size of the particular toolholder on the tracelet of the dividing engine. The desired angles of the ruling points are formed by lapping on a cast-iron lap charged with diamond dust. It is essential that all edges be free from nicks or irregularities.

Sharp Points.—When ruling on hard materials such as stainless steel the ruling point must be a sharp **V**. In ruling the lines with this type of tool the material is deformed and slightly raised on each side of the line and very little, if any, of it is removed by the point. These raised edges are readily removed with a cloth lap and magnesium oxide.

In making a sharp point at (*A*), the angle (*B*) can range between 80° and 140°. This large angle is necessary to strengthen the point for ruling the harder materials with the greater load carried by the point. In the points used the angle (*C*), or negative rake, was about 37°, and the angle (*D*), clearance, was 15°.

Because of a slight wear on the cutting edge of a new ruling point, several hundred lines should first be ruled on a specimen of the same material as the circle before the actual ruling of a circle is begun, to insure uniform width of line around the entire circumference. With one point, thus prepared, 80 circles were graduated on stainless steel with no apparent further wear.

Extreme care must be taken when lowering any point to the work to avoid any shock to the diamond which might cause it to chip, thus rendering it useless.

Flattened Points.—A flattened point is used when ruling on comparatively soft materials, such a silver and aluminum alloy, and when a rather wide line (from 5 to 10 microns or more in width) is desired. This type of point actually removes a fine shaving from the material, leaving straight parallel edges with a small bur at the edges of the lines. This bur can easily be removed by means of a pitch lap and chromium oxide.

On glass circles that have been coated with a wax resist, the flattened point is, of course, essential in order to avoid cutting the glass but still remove the coating com-

pletely. In this case the clearance, or negative rake, should be extremely small and the effective weight, or load, on the point should be but a few grams.

In making the flattened points used in this work, with the flat (*A*) of any desired width, the angle (*B*), which is the included angle between the two front-face cutting edges, was about 60°. The angle (*C*), negative rake, was approximately 30°, and the angle (*D*), clearance, was 13° or less.

THE CIRCLE BLANKS

Typical circle blanks (fig. 9) that have been graduated at the National Bureau of Standards have been made of metal, such as cast sterling silver, aluminum alloy, and stainless steel. The graduations on the circles are viewed in the theodolite either with reflected light or by using vertical illumination. A considerable number have also been ruled on glass; these are viewed by using transmitted light. Most aluminum-alloy circles as well as the cast sterling silver and stainless steel circles used in theodolites are now made with the supporting surface not recessed, thus giving greater stability and strength. Another advantage of having an exposed supporting surface is that it can more readily be lapped plane and parallel to the ruling surface.

A number of steps are necessary in the production of a circle. The specific steps depend on the material used.

Cast Sterling Silver.—There are 13 steps:

(1) Casting the sterling silver into a blank of the same shape as the finished blank and of a size approximately ⅛ inch greater in all dimensions than it is intended to be.

(2) Heat treatment to relieve any strains caused by casting. (After the disk has been cast and a fine cut has been removed to determine whether or not it is sound, it is ready for heat treatment to relieve the casting strains. The disk is placed in an electric muffle furnace and the temperature raised to between 550° and 600° C. in an illuminating gas atmosphere. This temperature is maintained for 2 hours and then the disk is allowed to cool in the furnace.)

(3) Machining the blank on all surfaces (to avoid any warping of the material) to a size very near to that required, drilling and tapping all screw holes used for mounting and centering the circle. (In case the supporting surface is of the recessed type, this surface near the flange, bearing the screw holes for centering purposes, must be relieved.)

(4) A second heat treatment to relieve any strains caused by machining, and to further stabilize the material. (After the disk has been machined to nearly its final size, the heat treatment is similar to the first one, except that the temperature is raised to only 400° C. and maintained at that point for 1½ hours before

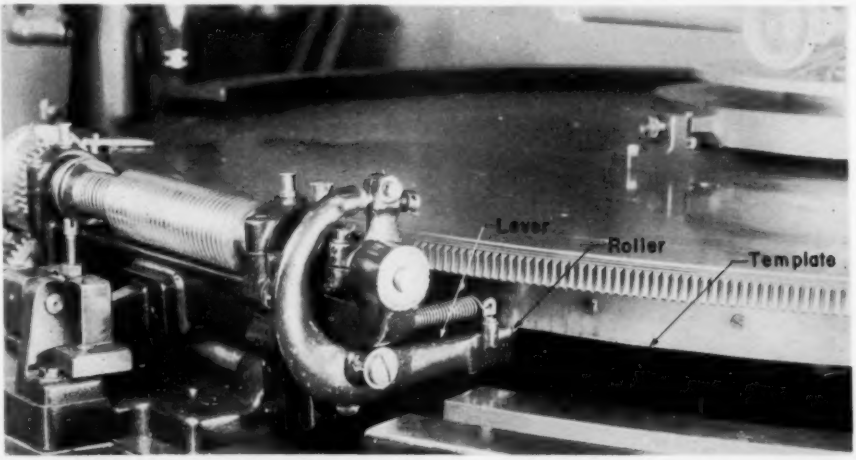

FIGURE 5.—Correcting device.

cooling. In this second treatment the disk is mounted on a special cast-steel mandrel which supports it at the periphery and at the center to avoid distortion.)

(5) Machining to the exact size, within permissible tolerances, while maintaining the supporting and ruling surfaces of the blank as plane and as parallel as possible. (No machining whatsoever should be permitted after the graduation has been completed.)

(6) Lapping the ruling surface on a lead lap charged with aluminum oxide, and lapping the

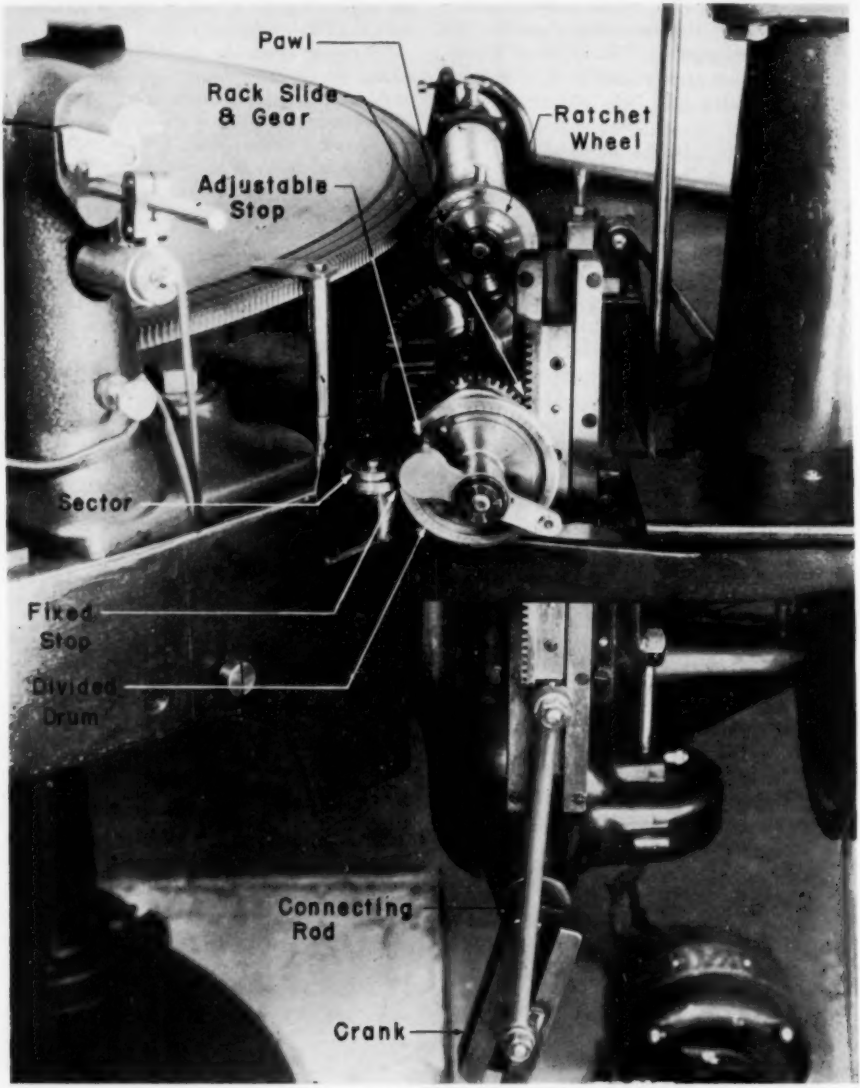

FIGURE 6.—Ratchet wheel.

supporting surface by means of a cast-iron lap with aluminum oxide, thereby removing all lathe marks.

(7) Lapping the ruling surface on a pitch lap, using chromium oxide, plane to 0.0002 inch across the full diameter.

(8) Adjusting the supporting surface parallel to the finished ruling surface to approximately 0.0002 inch by further lapping the supporting surface on a cast-iron lap with aluminum oxide. (Optical flats should be used in making the tests.)

(9) Inscribing the fine numerals on the ruling surface.

(10) Partial removal of the burs that encompass the numerals by using a pitch lap with chromium oxide.

(11) Graduating the circle.

(12) Complete removal of the burs from the graduations and numerals by again using a pitch lap and chromium oxide.

(13) Filling the graduations and numerals with printer's ink by the usual engraver's method.

Aluminum Alloy.—The steps involved in the production of a circle of the aluminum-alloy type are somewhat different from those used when producing a cast sterling-silver type of circle. There are eight steps and the procedure is as follows:

(1) Obtaining a blank of forged aluminum alloy (material known as Aluminum Company of America 56S-T, which has proved stable and satisfactory), of sufficient diameter and thickness; machining on all surfaces to the finished dimensions of the required circle while maintaining the supporting and ruling surfaces as plane and parallel as possible; drilling and tapping all screw holes used for mounting and centering the circle in the instrument. (The remaining steps in producing aluminum alloy circles, as given below, are essentially the same as those followed in the case of silver circles.)

(2) Lapping the ruling surface on a lead lap, and the supporting surface on a cast-iron lap, both with aluminum oxide, thereby removing the lathe tool marks.

(3) Lapping the ruling surface on a pitch lap

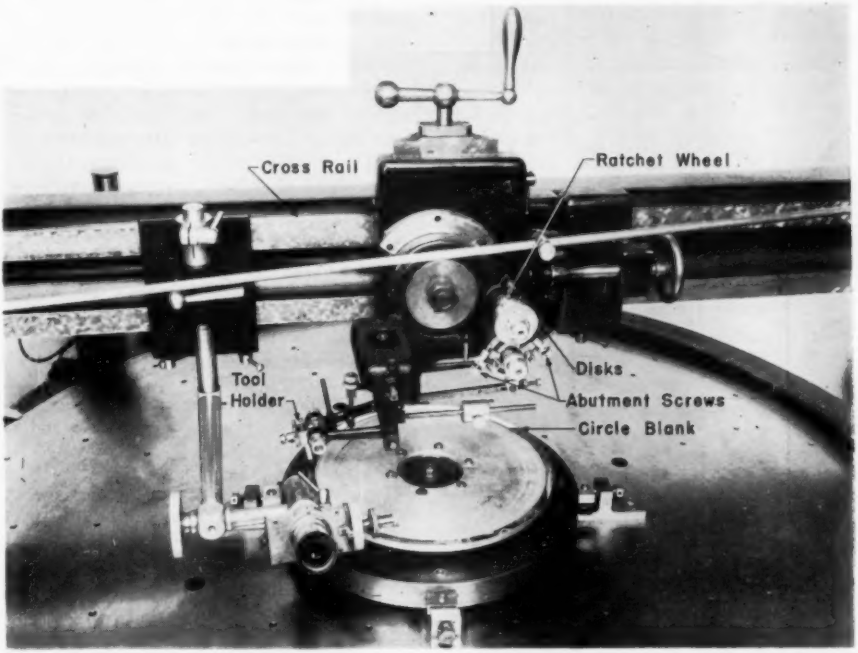

FIGURE 7.—Tracelet.

to the required planeness and parallelism of approximately 0.0002 inch.

(4) Inscribing the fine numerals on the ruling surface.

(5) Partial removal of the burs surrounding the numerals.

(6) Graduating the circle.

(7) Completing the removal of the burs from the numerals and graduations.

(8) Filling the numerals and graduations with printer's ink.

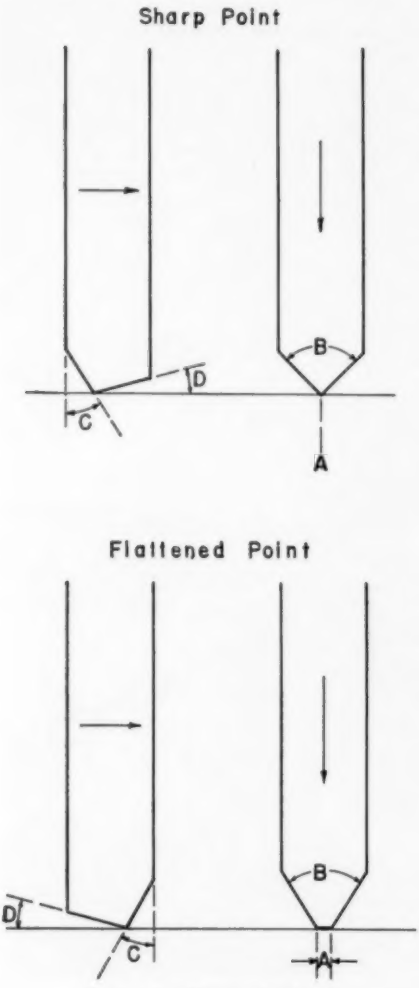

FIGURE 8.—Diamond points.

The final appearance of the ruled surface is that of a matte finish which is very satisfactory when viewing the graduations with reflected light.

In the event that the instrument is equipped with micrometer microscopes with provision for vertical illumination, and a higher reflecting surface is essential for greater contrast between line and surface, the procedure differs to the extent that the lead lap should not be used for the initial removal of the lathe marks, because the lead lap impregnates a slight amount of aluminum oxide into the ruling surface. In order to have a higher reflecting surface, all lathe marks should be removed with a pitch lap with chromium oxide. It should then be lightly polished on a cloth lap using magnesium oxide as the polishing material.

Stainless Steel.—In preparing stainless steel blanks, the use of stainless steel with a 13 percent chromium content (known as Firth Sterling, Grade-A cutlery steel) has been highly satisfactory. This material is exceptionally free from pits and inclusions, and, when polished, has a highly reflecting surface This material can be procured in the annealed state, but it is somewhat too soft for obtaining a highly polished surface, and should have further heat treatment.

The steps involved in the production of a circle made of stainless steel are as follows:

(1) Machining the blank on all surfaces to nearly the exact dimensions of the circle required, drilling and tapping all screw holes.

(2) Heat treatment, in which the disk is placed in an electric furnace and heated to 950° C.; this temperature is maintained for several minutes before quenching the disk in oil; the disk is then reheated to 600° C. and cooled.

(3) Grinding the ruling and supporting surfaces as plane and parallel as possible and to the dimensions required.

(4) Removing the grinding marks on both surfaces on a lead lap using aluminum oxide, and maintaining the surfaces plane and parallel to 0.0002 inch.

(5) Polishing the ruling surface on a cloth lap with magnesium oxide.

(6) Inscribing the fine numerals on the ruling surface.

(7) Partial removal of the burs from the numerals.

(8) Graduating the circle.

(9) Completely removing the burs from the graduations and numerals.

All polishing of the ruled surface, after graduating, should be done on a cloth lap with magnesium oxide. No filling is necessary in the graduations and numerals.

Glass.—In preparing and graduating glass blanks, the use of plate glass free from bubbles has been satisfactory. For small circles (4 inches in diameter) the thickness of the glass should be at least $\frac{1}{4}$ inch to minimize the possibility of warping when mounting on the dividing engine or in the instrument. If the circle is more than 4 inches in diameter, the thickness should be increased.

In the production of a glass circle the steps taken have been as follows:

(1) Cutting the glass ring to nearly the required size.

(2) Fine grinding the inner and outer edges and the upper and lower surfaces to size.

(3) Polishing both surfaces plane and parallel, with at least one surface free from scratches, using a cloth polisher with iron oxide.

(4) Thoroughly cleaning the surfaces with a chromic acid solution followed by distilled water and drying in a clean place free from dust.

(5) Coating with a wax resist.

(6) Inscribing the fine numerals on the graduating surface using a finely honed steel conical point. (This point should be lightly lapped before the ciphering is actually begun, so as to insure against any change in the width of line of the numerals from wear of the point.)

(7) Graduating the circle.

(8) Etching the glass with hydrofluoric acid either by fuming or by dipping.

(9) Filling the lines and numerals by chemically coating the surface with lead sulphide and then removing the lead sulphide coating from the surface of the glass by lapping on a beeswax lap with magnesium oxide.

The glass blanks are coated with a wax resist that incorporates such substances as asphalts, beeswax, gilsonite, resin, burgundy pitch, or combinations of these or similar substances. The ingredients to be used are dissolved in an organic solvent such as benzene and filtered. A small quantity of the solution is poured on the glass

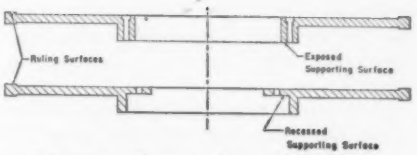

FIGURE 9.—Cross section of circle blanks.

while whirling it at a speed of from 200 to 800 r. p. m. Another method is to immerse the glass blank in the resist solution and then withdraw it at a slow uniform rate. A third method is to apply the resist hot. In this case the resist is made without solvents and is applied at a temperature considerably higher than the melting point of the mixture. These three methods are in common use in ruling and etching glass.

The processes and procedures used at the National Bureau of Standards for the resist coatings, the etching and filling of the graduations and numerals on glass circles, were developed by the Photographic Technology Section.

SETTING OF THE ENGINE

In preparing the engine for graduating, special care must be taken with regard to the vital parts of the engine, i.e., the worm, the worktable gear, the ratchet wheels that control the automatic repetition motion of graduation, and the tracelet. All the above parts must be cleaned and lubricated. The worm and gear are thoroughly cleaned with a fine bristle brush and benzol, and then lubricated with liquid petrolatum (without excess). Special care must also be taken to prevent any impurities (such as dust or lint) from adhering to the teeth of the gear, as these might cause errors in the graduations.

Leveling.—As most piers settle unevenly over a period of time (certainly when mounted on more or less compressible material), and as the worktable of a dividing engine must be level at all times when the engine is in operation, the engine was not rigidly bolted to the supporting block as was originally intended. At the base of the dividing engine three leveling screws were installed by this Bureau.

In leveling the engine a 2-second spirit

level vial (supported on **V**-blocks) is placed on the worktable; the engine is then leveled in the same way that a surveying instrument is leveled.

Adjustment of the Main Bearing.—After filling the oil cups at both the upper and lower bearings with clean spindle oil, the main bearing is then adjusted. This adjustment depends on the weight of the circle blank to be mounted on the table. When the worm screw is released from the worktable gear, it should be possible to rotate the worktable by hand under a tangential force of approximately 3 pounds. In making this adjustment it is preferable first to lower and then to raise the spindle, by using the thrust bearing screw, in order to eliminate the influence of the oil film existing in the conical bearings of the spindle. It is well to check that the worktable of the engine is level after the spindle has been adjusted.

A method of checking the correct adjustment of the spindle is to rotate the worktable by hand and observe the graduations, through a microscope, at the periphery of the table. If, at the moment the table comes to rest, the graduations drift slowly backward, it indicates that the spindle is too loose. In this case the thrust bearing screw should be lowered until no backward motion is noted, thus being assured that the spindle is in proper adjustment. After one of these careful adjustments several concentric circles were ruled on a test blank with the ruling point between the worm and the spindle and also beyond the spindle. These concentric circles were tested and it is interesting to note that no significant differences in errors of graduation were detected.

Adjustment of the Ruling Point.—A special holder for the ruling points was devised and installed on the toolholder frame of the tracelet. When adjusting any ruling point it is necessary that one be able to orient it completely, so that the lines will be radial and symmetrical, and will have clean sharp edges. The new holder will permit the following three orientations:

(1) Rotating around the axis of the shank, so that the ruling edge (in case of the sharp point), or cutting edges (in case of a flattened point) will be parallel to the direction of motion of the tracelet, causing an equal amount of bur to appear on each side of the line.

(2) Adjusting for symmetry of the two side faces of the diamond point with respect to the work, so that when drawing a line, the point of the line will be symmetrical with the two edges, and when cutting, the line will be of equal depth across its width.

(3) Adjusting the angle of the tool with respect to the work to obtain a clearance so that the tool will rule without chattering.

When these adjustments have been made, together with the determination of the proper effective load to be used on the point, and the trial lines have been examined under a microscope, and found to be acceptable, the ruling point is firmly clamped in the holder.

The tracelet is then moved along the crossrail to the center of the worktable. In order that all lines on a graduated circle will be radial with respect to its center, the ruling point must be centered with the axis of the dividing engine. This is done by ruling a line at the center of the worktable with the index of the worktable gear set at any given point. The table is then rotated 180° and a second line ruled. The toolholder and ruling point (as a unit) are then shifted laterally until two lines thus ruled are in perfect coincidence.

Adjustment for the Length of Line.—The length of the lines is obtained by adjusting first the two abutment screws which alternately contact the two disks selected for the graduation of any particular circle. Variations in lengths are obtained by adjusting the screws inserted in the notches of the notched disk. These screws have hardened contact ends, instead of the usual slotted ends, and are adjusted with a capstan pin. The setting of these screws is facilitated by actually ruling groups of short, medium, and long lines on a test sample, and measuring the differences in the lengths of each group with a micrometer microscope. The maximum length of line obtainable with our equipment is 20 millimeters.

Adjustment of Angular Movement.—The rotary movement of the worktable is obtained by use of the ratchet wheel at the end of the worm shaft. The periodic movement of the worm is limited by two stops (one fixed, the other adjustable) on a divided drum. These stops contact the upper and lower faces of a sector affixed to the frame of the engine.

As one turn of the worm is equivalent to an angular movement of the worktable of ½°, the fraction of a turn desired may be obtained by displacing the movable stop to the proper division on the divided drum.

The ratchet wheel to be selected for the graduation of a circle depends on the magnitude of the angular divisions required. In graduating a circle to angles of 5 minutes of arc each, one would select a ratchet wheel of 120 teeth, each tooth being equivalent to 15 seconds of arc. The pawl must then pass over 20 teeth of this ratchet wheel to obtain divisions of 5 minutes of arc.

The pawl device must have sufficient angular travel so that it engages surely in the proper tooth after having passed over the determined number of teeth.

MOUNTING THE CIRCLE BLANK

When all adjustments to the worktable, main bearing, ruling point, tracelet, and the periodic angular movement device have been completed, the prepared circle blank (previously inscribed with the numerals) is then mounted on the dividing engine.

To facilitate the leveling and centering of a circle blank on the dividing engine, a circular steel leveling and centering plate was constructed and semipermanently mounted at the center of the worktable. This plate is equipped with four leveling and four centering screws (90° apart) of ½ millimeter pitch, which bear upon hardened surfaces. An adjustable micrometer microscope was also mounted on a slide which can be moved along the crossrail ways. The microscope tube is set at an angle of about 30° with respect to the horizontal plane of the ruling surface. A beam of light is introduced from the opposite direction, and at the same angle to the surface, so that the ruling point, its reflection by the ruling surface, graduations, and numerals can all be observed simultaneously.

The circle blank is mounted on an optical steel flat in the same manner in which it will be mounted in a theodolite, and this assembly in turn is secured to the leveling plate. All strains caused by leveling and centering the circle are thus taken up by this plate and are not transmitted to the circle blank.

Centering.—After approximately centering the blank by using a dial gage in contact with its periphery, the final adjustment is made by using the micrometer microscope and centering with respect to the ring of numerals inscribed on the ruling surface. This is done by using two mutually perpendicular diameters, by first setting a cross wire of the microscope at either the inner or outer edge of the image of a numeral directly over one of the four centering screws, then rotating the worktable through 180°, and setting the cross wire on the proper edge of the numeral at this point. The cross wire is then set at a point equidistant between the two readings, and the leveling plate, with the circle, moved laterally, by means of the two centering screws, until the cross wire and the edge of the numeral are in coincidence. This same operation is repeated using the other diameter. In most cases it is necessary to repeat alternately the two operations until the ring of numerals is properly centered.

Leveling.—The same microscope is also used when leveling the circle blank to prevent any injury to the polished surface when contacted by a dial gage. The tracelet, with ruling point, is lowered on its slide to a position above the ruling surface where the reflection of the point is observed in the field of the microscope. The worktable is then rotated through angles of 90° at a time and the leveling screws are consecutively adjusted (by always raising the blank) until the edge of the reflection of the point is in coincidence with the same cross wire in the microscope at each of the four positions.

After the blank has been leveled the centering should again be checked.

Final Adjustment of the Tracelet and Ratchet Wheel.—When adjusting the tracelet, with its ruling point, for the graduation of a circle of any specified diameter, the microscope is first rotated about its axis until the longitudinal stationary cross wire is in a vertical plane, then the microscope is moved along the crossrail ways until the longitudinal cross wire appears at a specified distance from either the inner or outer edge of a numeral, as the case may be.

With the ruling point in its raised position, and at the termination of its longest stroke, the tracelet assembly is lowered until the ruling point is approximately ½ millimeter above the ruling surface. The microscope is then tilted until the reflected tip of the ruling point is in coincidence with the transverse stationary cross wire, and the movable cross wires set at a position equidistant between the image of the ruling point and its reflection. When the engine is in operation and the ruling point is in its lowered position, the image of the point will then be directly between the movable cross wires.

When these adjustments have been made, the microscope and the horizontal tracelet slide are firmly clamped to the crossrail ways, and the tracelet is raised in its vertical slide to insure that the ruling point will not touch the ruling surface when the engine is running freely.

With the ruling point in its raised position, and the adjustable stop on the divided drum in contact with the sector affixed to the frame of the engine, the worm is engaged with the worktable gear. The worm is then turned, by hand, until a numeral, preferably the numeral 1, appears directly between the movable cross wires in the microscope. The tooth of the ratchet wheel in which the pawl rests is then marked. It is the tooth in which the pawl must rest when the dividing engine is put into operation for the actual graduation.

GRADUATING THE CIRCLE

After all preparations have been made, it is necessary that the engine be run freely, that is, with the ruling point not cutting, for a period of at least 6 hours The oil films will then be evenly distributed, and the temperature of the entire engine will have become sufficiently uniform and constant. It is also necessary, after starting the actual ruling, that the engine run continuously until the circle has been completed. To insure this, battery service is supplied for the motor.

The engine is stopped at a moment when the ruling point is at the end of one of its longest strokes, and in its raised position; the tracelet is lowered until the image of the reflected tip of the ruling point is in coincidence with the transverse stationary cross wire; the tracelet is firmly clamped, and the worm disengaged from the gear of the worktable. The worktable is then rotated, by hand, until one of the numerals, of one digit, appears near the movable cross wires of the microscope, and the worm is engaged with the gear. The worm is then turned, by hand, until the pawl is in the marked tooth of the ratchet wheel, and the selected numeral appears directly between the movable cross wires, thus assuring that the long lines will be directly in line with the centers of the numerals.

The stroke counter located at the driving mechanism is next adjusted. During the operation of the engine, after each line is ruled, the number indicated by the stroke counter is lessened by one until the number reaches 9999 at which time the driving pulley will disengage, automatically stopping the engine. If, for example, one desires to graduate a circle to 10 minutes of arc, 2,160 strokes will be required; before starting the engine, the stroke counter should, therefore, read 2,159.

After starting the engine, for accurate dividing it is advantageous to make at least six strokes with the ruling point not cutting the surface. This is done by placing a ring of small weight on the counterweight rod of the tracelet, thereby keeping the ruling point above the ruling surface. For six extra strokes the stroke counter should then read 2,165. When the engine is in motion,

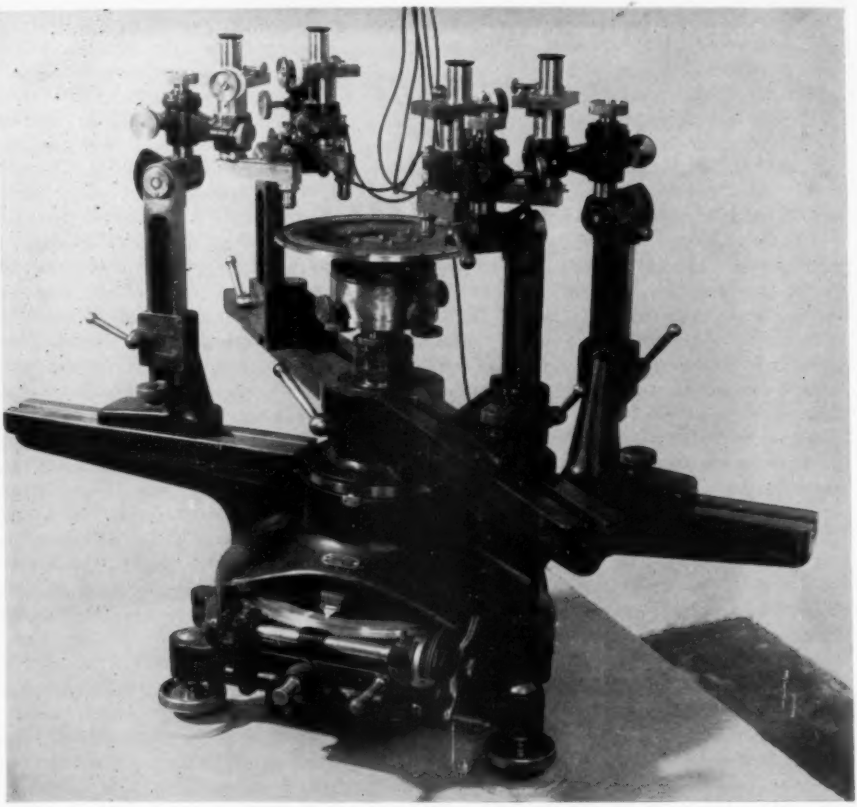

FIGURE 10.—Circle testing machine.

and the stroke counter indicates the number 2,159, the ring is removed, thus allowing the ruling point to lower to the workpiece and start the actual graduating.

TESTING THE CIRCLE

In order to determine the accuracy of our graduated circles, we have tested them on a special circle testing machine with four microscopes (fig. 10). This test is not a calibration of the circle, but merely a comparison of nominally equal angles in different parts of the circle. This test has been found to give results that are consistent with tests made by the United States Coast and Geodetic Survey using the circles assembled in surveying instruments.

HENRY WILD COMPANY OCCUPIES NEW OFFICES

The Henry Wild Surveying Instruments Supply Co. of America, Inc., has announced the removal of its executive offices, sales department, and repair facilities to its new and expanded quarters at Main and Covert Streets in Port Washington, N. Y. This transfer of location to its own modern, air-conditioned building will afford better service in sales and enlarged repair facilities by its factory-trained specialists.

Ten Thousand Maps at Your Service

By ALFRED C. STIEFEL
U. S. GEOLOGICAL SURVEY

A DAY of great technological advances in the field of surveying and mapping has dawned. Unfortunately, the new sciences and techniques developed in this field have not been used to their best advantage except in a very few areas of our country. When these advances in techniques begin to be utilized to their appropriate and fullest extent, our entire conception of surveys and maps and their use will have to undergo a change. It is a lamentable fact that only about one quarter of the United States is considered adequately mapped by the standards now commonly accepted by the map users. For almost 40 percent of the United States, no topographic maps of any kind are available. With an expanded program, it is to be hoped that maps for the entire United States and Alaska can be provided within 20 years.

EFFICIENT USE OF AVAILABLE MAPS

Although much of our country still needs to be mapped, we should endeavor to make the maximum use of the maps that are at hand. There are actually over 10,000 standard quadrangle maps that have been published and are now available. A large number of these maps have been produced since the close of World War II and meet the national map accuracy standards. Others are lacking in one or more elements required to meet these standards but are valuable for many uses. An appreciation of the relative merits of these maps, produced over the past 70 years, is important for their proper utilization by engineers.

During the current fiscal year, the Topographic Division of the Geological Survey will publish between 900 and 1,000 new topographic quadrangle sheets of areas in the United States, Alaska, and Hawaii. Other divisions of the Geological Survey, as well as many other agencies of the Federal government, are carrying on numerous investigations and services in the collection of basic data on many diverse subjects that are often important for the civil engineer. Much of this data is recorded on maps and reports with which he should be familiar.

In this paper I will restrict my comment mainly to topographic maps, which are the foundation for most of these other studies. I would like to refer, however, to a few government reports, listed in the bibliography accompanying this paper, which present brief outlines of some activities of Federal agencies engaged in natural-resource surveys.

Some States are playing an active part in providing the kind of modern topographic maps which are desired and necessary from the viewpoint of the civil engineer. An outstanding example is the current cooperative program between the State of Kentucky and the U. S. Geological Survey. This mapping program was initiated by the Kentucky Agricultural and Industrial Development Board as the first step in its accelerated program for the development of the resources of the State. Under this program the entire State of Kentucky will be covered by some 700 standard 7½-minute quadrangles at the scale of 2,000 feet to the inch. These will be completed and published during the next few years.

Many other States are maintaining active cooperation with the Geological Survey. Under these cooperative agreements, long-range programs of quadrangle mapping are carried out in accordance with carefully considered schedules designed to meet the requirements of State agencies and other map users.

Publication authorized by the Director. U. S. Geological Survey.

Presented at the Third National Surveying Teachers' Conference at Blackduck, Minn., August 3–8, 1952.

THE ENGINEER AS A MAP USER

The civil engineer, as a professional man, may be a surveyor and a map maker but more often he is a map user. In this latter capacity he employs surveys and maps as tools and techniques in such undertakings as the planning of power or irrigation projects, or the design of airports with all their attendant facilities.

When we speak of surveys, I think we need to keep in mind that the civil engineer is concerned with a broad field of factual information which embraces all kinds of basic data concerning our land and its resources. It is generally recognized that topographic maps form the essential base for the collection, recording, and investigation of such information as hydrology, geology, soils, and vegetation. All these facts, and results of various kinds of surveys, are part of the required basic information for the planning, design, and construction of engineering projects for the development of our resources. At every stage in the development of a project, a certain amount of general and specific data is required.

The civil engineer is concerned with all these basic facts in the performance of his professional responsibilities. Whenever possible he will secure these fundamental facts from published maps and reports that have been prepared according to accepted standards of accuracy and content. He may then devote his attention to the analysis and use of these facts as they may be germane to the matter at hand.

A rather comprehensive report on the use and relative need of maps and aerial photographs in highway engineering is given in a paper entitled "Aerial Surveys in Highway Location," by William T. Pryor (*see* Bibliography, item 5). In this paper Mr. Pryor stresses the importance of using all available surveys and maps for reconnaissance and preliminary route studies before field surveys are undertaken.

The use of topographic maps as tools in the hands of the highway engineer is likewise very well described by Curtis J. Hooper, in a paper which he presented before the National Highway Research Board at its annual meeting in Washington, D. C., January 9–12, 1951 (*see* Bibliography, item 6). The entire State of Connecticut is covered with topographic quadrangle maps which are the basic data for the reconnaissance studies of highway projects. After proposed routes have been selected for more intensive study, larger-scale topographic maps, designed to meet the specific requirements of the highway department, are ordered. These maps, which are required to meet rigid specifications as to accuracy, are produced by private engineering contractors. Mr. Hooper states that the contractors are not required to use a prescribed method in preparing these maps but that the maps are carefully checked to see that they meet the specifications. The highway engineers can thus devote their attention to design. Instrumental field surveys are largely limited to staking the final location.

TRAINING IN MAP APPRECIATION

A famous art critic has said that a real appreciation of a great work of art can be realized only if one has some comprehension of the skills and techniques involved in the creation of a great painting. Engineering maps are likewise the result of many specialized skills and precise techniques. Some knowledge of these techniques, their possibilities, and their limitations is necessary for an appreciation of the maximum use of topographic maps. This education and training is, I believe, a proper function of the surveying and mapping courses in a college of civil engineering in preparing young men for a professional career.

The wealth of information upon a quadrangle map, told in a language of symbols, reveals the culture, topography, drainage, and physical facts of the terrain. But just as a book in a foreign language can be useful only if the reader has a basic knowledge of that language, so the only way to appreciate, understand, and use a map is to acquire a vocabulary for its translation. The best way to acquire this vocabulary is by making a map. To have a knowledge of the techniques of surveying and mapping gives a solid basis for understanding.

The engineering colleges, in their courses of instruction on surveying and mapping, should prepare the engineer to know how to check and evaluate maps. This instruction should be directed primarily to equipping the student to perform this task by becoming familiar with the use of the various instruments and equipment employed and at the same time to make the necessary field checks to evaluate available map material and aerial photographs.

About two years ago I talked with a well-known consulting engineer whose firm was engaged in making a study of some twenty World War II military installations in this country, including airports, factories, power plants, warehouses, and other facilities. They were examining these facilities to determine which should be rehabilitated, and what construction, extensions, or modifications would be required to fit them into the new requirements of the Department of Defense to meet the existing emergency. To handle this work it was necessary for the firm to expand its engineering staff and to employ men who could read maps. This prominent engineer told me that he had no difficulty in finding competent engineers for studying the structural, mechanical, heating, ventilating, electrical, and power problems. On the other hand he just could not find men who, in addition to sound engineering experience and training, were able to read and interpret maps for the conditions involved. He said that his firm was willing to pay top salaries to engineers with such ability, but that they were unavailable.

AVAILABLE MAP COLLECTIONS

In addition to the topographic quadrangle maps which I have mentioned before, there are actually tens of thousands of additional maps and charts that are available from Federal and State agencies for the use of the civil engineer. The Map Division of the Library of Congress has in its collection a total of over two million maps, not counting some 18,000 atlases and 30 globes. Many public libraries and most of our college and university libraries have map collections, some of which are maintained under the direction of trained map librarians and are available as reference materials. The student engineer is trained in the use of technical libraries for reference to books and publications that he cannot be expected to own and keep as his personal property. As part of the education of the undergraduate engineer, he should also receive some knowledge of this vast amount of map reference material, and of its content, availability, and possible uses in engineering planning, design, and construction.

Few people, including engineers, are aware that map collections are maintained at the public libraries. Although some of these libraries do not have adequate facilities for filing and servicing their map collections, required facilities could be provided if demanded by the map-using public. An interesting sidelight on this subject may illustrate the point. On a recent visit to a State university to address a student chapter meeting of the American Society of Civil Engineers, I inquired what use was being made of the Geological Survey topographic maps of the United States. The civil engineering professor assured me that they were using a few of the local quadrangles in their courses, but he did not know of any map depository on the campus. He was very much interested, however, and, after a careful search in the main library, we found only a few unrelated topographic maps in the miscellaneous map collection. We finally located the depository of the Geological Survey quardangle sheets in a corner of the library of the geology department. They were piled on top of an old wooden map cabinet, collecting dust, and several large shipments received during the past year had not even been unpacked. After we had called this matter to the attention of the librarian of the university, he assured us that something would be done about it—and it was. An interesting comment of the librarian was that as soon as it became known that these maps were available there were so many calls for the maps that they had great difficulty in

completing the big job of sorting and filing the maps so as to make them available for use.

What is the situation on your campus? The Geological Survey sends copies of all its new maps to a large list of libraries in the United States. We are interested in these map collections and hope that they will be maintained and serviced so that they may be of maximum use to the public.

THE UNIVERSITY MAP LIBRARY

To effectively train our future engineers to use maps and charts for reference materials as they do technical handbooks, the maps should be readily available for use. A collection of maps, representative of those available from government and commercial sources, should be maintained in the library of the civil engineering department of each university. These maps should not be just a few samples, but should include complete coverage of the topographic maps of the State, or of some considerable area in the vicinity of the university, at various scales. Indexes, map catalogs, and related publications should be an important feature of this map collection.

(Courtesy The Library of Congress)

MAP FILE FACILITIES OF THE LIBRARY OF CONGRESS

The two million maps in the collections of the Library of Congress Map Division have recently been moved to new air-conditioned quarters in the Library's Annex building. This view down one of the aisles in the map deck shows a number of banks of steel drawers in which the maps are filed. Currently the collections fill some 9,000 drawers.

The total number of maps in this special working collection might range from a minimum of about 300 to 1,000, most of which would be obtained from various government agencies. A map collection of this size can be housed in two 5-drawer steel map cases. Such cases, when provided with bases and caps, constitute compact units with table-height reference surfaces. A recommended drawer size is 44 inches by 30 inches by 2 inches deep. (*See* Bibliography, item 11.)

The maps in this minimum collection for a civil engineering department might include 200 or more topographic quadrangle maps of the Geological Survey at the scales of 1 : 24,000 and 1 : 62,500, as well as shaded-relief maps of a selected number of quadrangles. Representative samples of the new 1: 250,000 scale series should also be included. Other important Geological Survey items are State base maps, special river surveys, State indexes of geologic mapping, geologic folios, geologic quadrangle maps, and maps of the coal, oil, and gas series. Many other Federal agencies also produce maps and reports which should be included in this collection. Some of these are the sectional aeronautical and nautical charts of the Coast and Geodetic Survey, soil maps and soil survey reports of the Bureau of Plant Industry, weather maps of the U. S. Weather Bureau, and cadastral surveys of the Bureau of Land Management. Inquiries regarding published maps of the Federal Government may be directed to the Map Information Office of the U. S. Geological Survey, Washington 25, D. C., which serves as a clearing house for map information, including aerial photography and basic control surveys.

Many State agencies and some counties and cities publish maps which should be included in this collection. Nearly every State highway department publishes a popular highway and road map as well as a highway atlas on a county sheet basis. The National Geographic Society publishes a good series of maps that will serve as a world atlas. The American Geographical Society publishes many valuable maps including an excellent 5-sheet map of the Americas at the scale of 1: 5,000,000. Representative maps of other leading commercial map-making concerns should also be included.

The courses in the civil engineering curriculum should be designed so that these maps will be in frequent use by the students, especially the upperclassmen. Instead of theoretical problems in the design of engineering facilities, the student can select a real town or site with actual situations and secure much of the necessary information from the published maps and government reports. By such constant use and reference to maps the student will become conscious of their value and application as practical tools in engineering.

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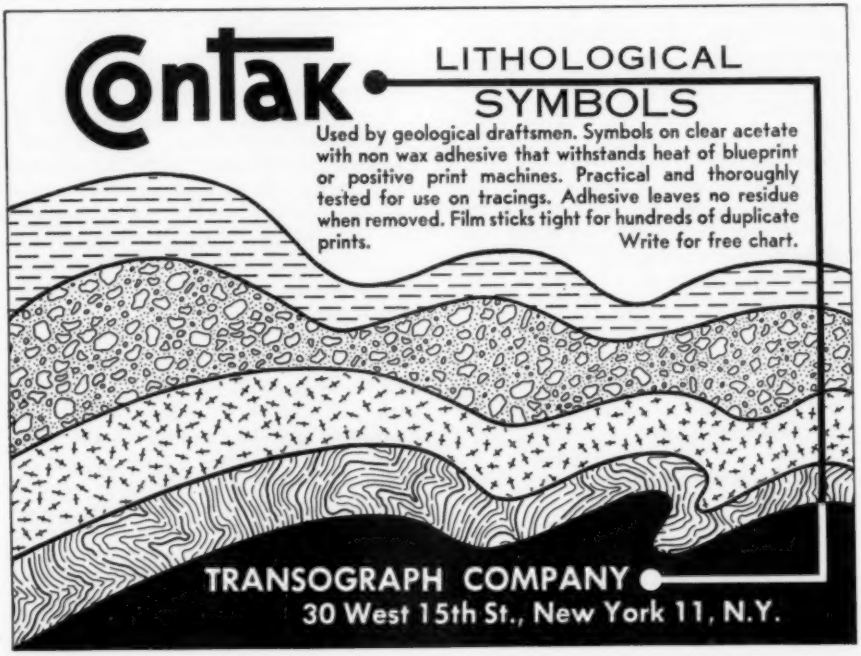
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A Proposed Ecological Vegetation Map

By HENRI GAUSSEN

UNIVERSITY OF TOULOUSE, FRANCE

AN INQUIRY into the food resources of the world is being made by the F.A.O. (Food and Agricultural Organization). The vegetable kingdom is the fundamental source of food. As vegetation is best shown by means of a map, a world map of plant resources is now being considered at the scale of 1:1,000,000 (that of the international map of the International Geographical Union). This is an important project, and its result must be of maximum usefulness.

Four questions arise:

I. What data are to be shown?
II. What colors are to be used?
III. How are these colors to be used?
IV. Inset maps.

I. DATA TO BE SHOWN

This question was raised at the International Congress of Geography in Lisbon (1949) and the International Congress of Botany in Stockholm (1950). The first idea which comes to mind is to distinguish between the different types of cultivation and of the natural vegetation; in short, to photograph the earth's surface at the scale of 1:1,000,000 and to show what is seen. This is the procedure followed in the world Land-Use Survey Project. Its proposed divisions and colors are:

1.	Urban areas	dark and light red
2.	Horticulture	dark violet
3.	Tree, bush, and vine crops	light violet
4 a.	Rotation crops	dark brown
b.	Temporary cultivation	light brown
5.	Meadows (hay)	light green
6 a.	Pastures	orange
b.	Unused grasslands	yellow
7 a.	Dense forests	dark green
b.	Open forests	light green
c.	Shrub vegetation	olive green
d.	Swamp forests	blue green
e.	Secondary forests	green hatching (on corresp. shade)
f.	Forests with cultivation	green with brown dots
8.	Fresh or brackish swamps; no forests	blue
9.	Wastelands	gray

Such a map with the help of overprints would permit us to indicate the types of cultivation and the natural vegetation. In the "Atlas de France" such useful information has been given. Moreover, we can give a statistical value to the symbols used in the overprints. For example: the symbol for the vine may represent 100 hectares (247 acres) of vineyards; the symbol for the olive tree may represent 10,000 or 1,000 trees according to the size of the symbol.

Thus, we satisfactorily fill the F.A.O's request for an illustrative map, but I think it is possible to do much better. Such a map is purely "static" and, 20 years from now, many things will have changed. Several changes can be foreseen, once the "dynamic" aspects of vegetation are known.

The Land-Use Project gives no indication of this matter; however, for economic purposes, a dynamic study is essential. Studying the present land use shows us our present economic wealth, but it is useful also to know what changes are possible in the present vegetation cover. These possibilities are the result of the permanent environmental conditions, and knowing the environment is to know all possibilities, of which the present is only one.

Knowledge of the environment is permanent and useful. At the International Congresses of Lisbon and Stockholm, therefore, I proposed that a colored map at the scale of 1:1,000,000 be compiled; colors to show environmental conditions and color patterns to show the present conditions of the vegetation. We can designate such a map as an Ecological Vegetation Map.

Such an ecological map contains all the information in the Land-Use Survey map; in addition, it explains the vegetation. It

shows the changes that are possible. Where, in two parts of the world, the map shows the same color, it means that ecological conditions in both places are the same and, thus, their cultural and natural vegetation can be interchanged. Therefore, an ecological map is better than the proposed Land-Use Survey map.

Now, I shall explain ecological mapping by means of an appropriate choice of colors.

II. CHOICE OF COLOR

1. *Land-Use Survey map.*—We have already seen what colors were proposed by the Survey. I have not seen any discussion about their choice. Woods are shown in green, swamps, in blue, etc.; I can see no methodical use of colors in this procedure.

2. *Ecological map* (proposed at Lisbon and Stockholm).—The environmental factors act simultaneously. We can try to show their effects on the map by the use of color. Therefore, in 1926 I established a synthetic map of the environment of Foix (a small town on the Ariege in the Pyrenees) at the scale of 1:200,000. Several monochromatic maps were superimposed on the same base map: an insolation map in yellow, a shade map in black, a humidity map in blue, and so on. The superposition of these monochromatic maps resulted in a map of complex colors. The xerothermic parts, the slopes adapted to forests, the parts adapted to meadows, etc., stood out very clearly. In short, the methodical use of color gave very conspicuous results. In more recent maps, the process has been improved. Let us now see what proposals on the subject were made at the Congresses of Lisbon and Stockholm. Six environmental factors are to be superposed on the base map: (1) temperature; (2) humidity; (3) xerothermic factor; (4) light; (5) length of growing period; (6) nature of soil. If one attempts to superpose six colors, a rather nondescript color will result; therefore the factors 1, 2, and 4 are represented by color, and factors 3, 5, and 6 only by colored symbols.

When a factor has a mean value, its action is not manifest. On the other hand, it assumes much greater effectiveness if it is near its minimal value (if this factor is indispensible for plant life) or near its maximum. Therefore, logic dictates the use of bright colors where environmental factors become extreme, and a pale color or none at all to show mean values.

Moreover, a high temperature, an excessive dryness, or a bright light have analogous physiological effects; it is logical to give then analogous tints—oranges and reds have been selected.

Still, how shall we represent, for example, the humidity factor? It is fallacious to assume that the color range for humidity will result from the mean annual precipitation. Two places, *A* and *B*, with the same annual rainfall can be very dissimilar insofar as humidity goes. If it rains more frequently at *B* than at *A*, *A* shall have a drier classification—in spite of the equality of the annual mean.

At times, it is not necessary to estimate each factor with extreme precision, so long as other factors compensate for the imperfections. Therefore, if we use the same color of humidity for *A* and *B*, the xerothermic factor will partly compensate for this mistake—the number of dry days in *A* being greater than in *B*.

The following table is proposed:

A.—Fundamental Factors

(1) *Temperature* (*T*).—There are six principal divisions, T_1 to T_6, and intermediate divisions. (For example, $T_{3/4}$ is between T_3 and T_4.)

T_1	very cold	tundras, alpine vegetation	dark gray points
T_2	cold	Leningrad	light gray
T_3	cool	Paris	white (without color)
T_4	warm	Lisbon	golden yellow
T_5	hot	Libreville	chestnut-orange
T_6	very hot	Djibouti	chestnut-orange-red

(2) *Humidity (Dryness)* (*S*).—There are six principal divisions, S_1 to S_6, and intermediate divisions (for example, $S_{3/4}$).

S_1	very humid	Buitenzorg	dark violet
S_2	humid	Tokyo	dark blue
S_3	subhumid	Paris	light cobalt blue
S_4	subarid	Marseille	white (without color)
S_5	arid	Zaragoza	sulphur yellow
S_6	very arid	Sahara	orange yellow

(3) *Xerothermic factor* (*X*).—Dryness can occur during either warm or cold seasons. The physiological effect on plants is not the same.

A "dry month" is here defined as a month with:

10 mm rainfall and with an average temperature of $< 10°C$
10–25 mm rainfall and with an average temperature of 10°–20°C
25–50 mm rainfall and with an average temperature of 20°–30°C
50–75 mm rainfall and with an average temperature of $> 30°C$

During dry months we have to count the days without rain. A day without rain, but with dew or fog all day long will count as a half-day.

We count the number of "dry days" during the dry months, but are not interested in dry days in the other months.

Dry days	*Xer. factor*	*Spacing and color of symbol*
50	X_1	blank
50–100	X_2	widely spaced orange red ⋀
100–150	X_3	closely spaced orange red ⋀
150–200	X_4	closely spaced orange red △
200–250	X_5	closely spaced orange red ▲
250	X_6	closely spaced orange red ▲

(4) *Light factor* (*L*).—Two types of strong light effects can be distinguished: great actinic power as in high altitudes or in some tropical regions, and long duration of insolation as during summer days in high latitudes.

There are three divisions:

L_1	feeble light	gray stippled
L_2	medium light	without color
L_3	strong light	rose stippled

Long days in high latitudes are counted as $L_{2/3}$.

(5) *Length of growing season* (*V*).

V_1 less than 6 months.
The forests are rarely dense and are shown by large dots.
Shrubs and bushes, by hatchings.
Herbaceous vegetation by light stippling.

V_2 from 6 to 9 months.
Forests are shown by flat color.
Shrubs by thick hatchings.
Herbaceous vegetation by dense stipplings.

V_3 over 9 months.
Colors as in V_2 with an overprint of fine wavy, vertical, indigo lines.

Deciduousness is always shown by fine white oblique lines.

(6) *Soil factors.*—Where the soil is indeterminant we can disregard it, and in the "diagnosis" we can put a 0 (zero). In other cases we can distinguish, at the scale of 1:1,000,000*:

A	Aquatic with fresh water	Horizontal short thick blue bars
	Temporary fresh water	White and blue bars alternating
T	Turfy or acid water	Dark brown short thick bars
M	Salt water	Red short thick bars
	Brackish water	Fresh water and salt water signs, combined
Ta	Turfy acid soils	Dark brown crosses
Ag	Clay	Violet ⅂ (inverted *L*)
L	Laterite	Violet L

B.—Additional Factors

Additional factors may be shown whenever this is useful; e.g., wind, duration of snow cover, frost, etc.

C.—Ecological Diagnosis

Each ecological complex can be shown by a formula. The color interprets the formula. For example:

The ecological conditions for the beech forest in French mountains are:

T_3	S_2	X_1	$L_{1/2}$	V_2
white	dark blue	white	white	deciduous foliage fine white oblique lines

This amounts to dark blue with fine white oblique lines. For a grass layer on the beech forest floor, use dense blue stippling.

The ecological conditions for the oak forest in French lowlands are:

$T_{3/4}$	S_2	X_1	L_2	V_2	0
light golden yellow	dark blue	white	white	fine white oblique lines	white

This amounts to blue-green in flat color with fine oblique white lines.

The ecological conditions for the Guinean mangrove forests are:

$T_{4/5}$	S_1	X_1	$L_{2/3}$	V_3	Sm
yellow orange	dark violet	white	rose stippled	fine indigo vertical wavy lines	red crosses

This amounts to chestnut violet in flat color with wavy indigo lines and red crosses.

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* Larger scales permit more detail and the above list may be expanded to include the following:

H	Humid soil	Checkered blue lines
	Very humid	Blue crosses
S	Alkaline soil	Red crosses
Sm	Brackish soil	Red and blue crosses
Tb	Turfy basic soils	Orange crosses
Hu	Acid humus	Dark brown crosses
	Alkaline humus	Light brown crosses
Ca	Calcareous soil	Yellow crosses
Ar	Sandy soils	Fine yellow points
ArS	Salty sandy soils	Fine red points
AgL	Lateritic clay	Violet L and ⅂

The ecological conditions for the Senegal dry and lateritic parkland with *Bombax* are:

$T_{5/6}$	$S_{3/4}$	X_5	L_3	V_1	L
chestnut orange	white to light blue	orange	rose points	big and little points	violet

This amounts to big and little chestnut light orange points, closely spaced orange $\wedge$ symbol and violet L symbol.

III. HOW TO USE THE COLORS

1. *Land-use map.*—On the Land-Use map flat colors are used, in most instances. Hatching is used only for the secondary forests. An overprint of symbols distinguishes the various types of land use or forest, etc. As a result, one cannot immediately understand the ecological conditions. There is no color differentiation between a fir forest in Germany and the dense equatorial forest of the Amazon. The map is not too informative and lacks depth if only flat colors are used. Each color shows only one thing. By using hatching, stippling, small and large dots, bars, etc., each color can be made to serve several purposes.

An advantage of the ecological map is the large number of items which can be shown on it.

2. *Ecological map.—Human activities.*—The following system shows human activities. White is used for this purpose and, also, horizontally arranged symbol patterns.

Cultivated fields	white
Improved meadows	colored symbol (") on white ground
Cultivated trees	hollow circles or squares or diamonds
Reforestation	large, horizontal, colored rectangles

The color shows the ecology of the particular land use. For secondary equatorial forest, human activity can be distinguished by white horizontal rectangles on the colored ground. For temporary cultivation, large horizontal rectangles alternating with the colored representation of the fallow can be used. If we have 1 year of cultivation and 2 years fallow, the white rectangle is half the size of the colored rectangle.

The symbols for cultivated trees or shrubs (including the vine), etc., have statistical value and supply statistical information (e.g. symbols may signify 1,000 apple trees or 100 acres of vineyards, etc.).

Seminatural vegetation. We speak of seminatural vegetation where human activity has not completely transformed the natural landscape. This is shown as follows:

Barren soil	very fine stippling
Herbaceous plants	stippling
Low shrubs	hatched (cf. (5) *Length of growing season*)
Tall shrubs	checkered
Trees	flat color or thick signs (see *id.*)

Lakes and oceans are best shown in very light blue; ice may be white with blue contours.

IV. INSET MAPS

A number of inset maps may be placed along the margin of both the Land-Use Survey map and the Ecological map. The "Carte de la Vegetation de la France" at the scale of 1:200,000 has the following six inset maps at 1:1,250,000:

(*A*) Climax vegetation
(*B*) Soils
(*C*) Land-use and orchards
(*D*) Agriculture
(*E*) Precipitation and temperature
(*F*) Agricultural hazards

For maps at a scale of 1:1,000,000 the inset maps can be at the scale of 1:5,000,000. Only maps (*A*), (*C*), (*D*), and (*E*) will be useful. The pedological map has little value at this scale.

V. CONCLUSION

The ecological map is extremely informative; it contains all the data that the Land-Use Survey Project uses and much more besides. Ecology explains the present vege-

tation. Environmental conditions are the only stable conditions; they explain the present vegetation and show the chances for improvement.

Using the ecological diagnosis and color method, we can say:

1. If two points in the world have the same diagnosis, they are equivalent and all plants are interchangeable.
2. If two points have the same synthetic color or nearly the same, they are equivalent, or nearly so, and most plants are interchangeable.
3. If two points in the world have neither the same diagnosis nor the same color, we must experiment before interchanging the plants.

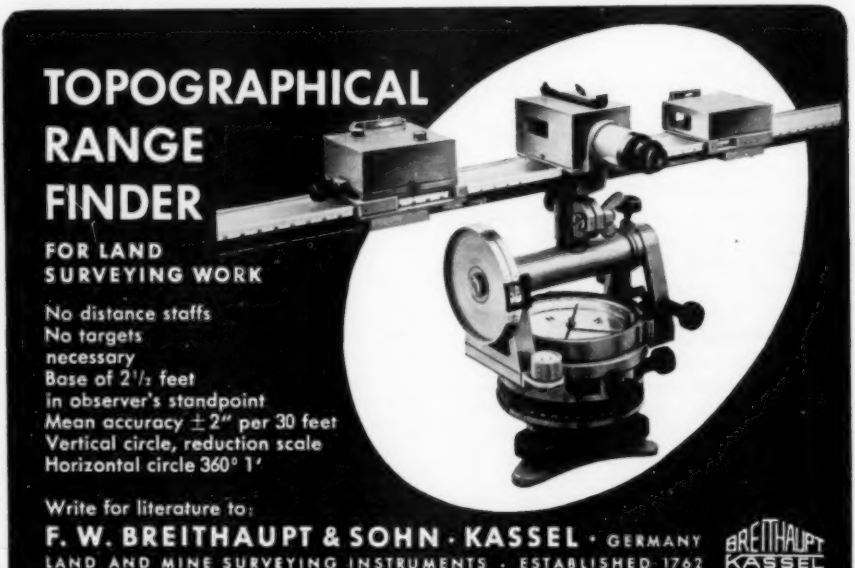
Not only will the ecological map contain the data of the F.A.O. world inquiry, but its economic value in agriculture, forestry, plant breeding, etc., is great.

New Industrial Transit

The Optoplane—a new industrial model of the Gurley Precise Transit for facilitating jig and fixture location and alignment—has been added to its line of transits by W. & L. E. Gurley, Troy, N. Y.

The Optoplane, developed in cooperation with aircraft plant engineers, is already in use by plane builders for establishing the horizontal and vertical planes necessary in locating and setting up jigs for sectional assembly. Built to the precision of the best engineers transits, the instrument permits jig alignment and coordination with tolerances of thousandths of an inch.

The new instrument does not incorporate a vertical circle or horizontal limb, since angles are not required in jig assembly.



Contour Interval Problems

By GEORGE D. WHITMORE

U. S. GEOLOGICAL SURVEY

AT THE 1952 meeting of the American Congress on Surveying and Mapping a symposium on the subject, "Selection of Contour Intervals," was presented, with discussions by Messrs. Eliel, Woodward, DaSantos, Griffith, and Lyddan. A full report of the symposium was published in the Oct.–Dec. 1952 issue of SURVEYING AND MAPPING. Although many important considerations were brought to light in the course of these discussions, no specific conclusions were reached, and there was no summary discussion. The Chairman of the Topography Division of this Congress, Shirley B. Griffith, regards this as a matter of unfinished business, and has, therefore, requested me to review these symposium papers and prepare a brief summary. This I am very glad to do, although I cannot presume to arrive at conclusions for all of the questions that have been raised. Rather, I shall attempt to codify and restate in an orderly manner what seem to me to be the principal questions that are bothering both the special-purpose mappers and the general-purpose mappers. I will also venture to suggest certain solutions or courses of action with respect to these questions.

In considering this matter of contour intervals it should be noted that an interesting study was made in 1952 by M. M. Thompson and C. H. Davey on the subject of "Vertical Accuracy of Topographic Maps." The resulting paper appears in the journal SURVEYING AND MAPPING for Jan.–Mar. 1953. This study by Messrs. Thompson and Davey bears directly on the question under consideration, and should be reviewed by all students of the subject. It will be referred to frequently in this paper.

Presented at the Thirteenth Annual Meeting, American Congress on Surveying and Mapping, March 23–25, 1953, Washington, D. C.

For the purpose of directness and simplicity, I have arranged this discussion in the form of a series of 10 questions and answers, as follows:

Question 1.—Are different criteria used in selecting contour intervals for general-purpose maps than for special-purpose maps?

Answer.—Yes, frequently. On general-purpose maps, the scale of each series of maps is fixed, and the contour interval, therefore, must be varied from area to area, or from sheet to sheet, according to the character of the terrain, so as to be suitable for the predetermined map scale.

For special-purpose maps, the situation is often just the reverse. When the need for a certain contour interval is the paramount requirement, the map scale must be selected to accommodate the contour interval.

Question 2.—Is there a practical rule or formula for determining optimum contour interval for general-purpose maps?

Answer.—No, no such rule or formula has yet been found, although several attempts have been made. We still rely on the professional judgment of experienced topographers. The objective is to select a contour interval for each specific area that will be optimum for most of the terrain. Where extremes of relief are within the area, there results a paucity of contours in the flat terrain, and an excess of contours on the steep slopes.

Question 3.—Would it be practical to use several basic contour intervals on a general-purpose map, changing the interval in accordance with the ground slope?

Answer.—Although this has been done, notably in Germany, it is sometimes confusing and is not in accord with the traditional American preference for simplicity. However, on our general-purpose maps that encompass steep mountainsides, rolling hills, and flat bottomlands, we do have, in effect, three contour intervals. That is, for most of the map there is the basic interval which, for the purpose of illustration, will be assumed to be 20 feet; then on the extremely flat terrain there will be dotted-line supplemental contours at a 10-foot inter-

val; and on the steep mountainsides only the accentuated 100-foot contours would be discernible on the final map, so that in reality the interval on such slopes is 100 feet. Thus on such a map it might be said that we use the three contour intervals of 10, 20, and 100 feet.

Question 4.—Is use of supplemental contours, at half-interval, quarter-interval, or one-fifth interval, advisable for the flatter slopes of all map sheets, regardless of the type of terrain?

Answer.—No, because from a practical standpoint supplemental contours are feasible only when there are marked extremes in ground slope. If we attempted to use supplemental contours on a map that depicts only one type of terrain (whether it comprises mountains, hills, glacial moraines, sand dunes, flatlands, or swamps) we would soon find that there are no logical starting or stopping places for supplemental contours, and either we would end up with a map that is in effect using the supplemental-contour interval as the basic interval, or we would have both the map maker and map user confused. Supplemental contours are useful features, but it will be found in practice that they are suitable only for terrain having extremes of steepness and flatness.

Question 5.—Are the traditional American specifications for the accuracy of contours satisfactory for general-purpose maps?

Answer.—Yes, in the main. These specifications have been in use for at least 40 years, and so have the virtue of familiarity. Furthermore, they are simple and practical in application, providing always that an appropriate contour interval is used. However, perhaps they should be modified to provide in some manner for greater relative accuracy in flat terrain.

It may be that we would do better to express vertical tolerances in terms of standard deviation, and vary the tolerance in direct ratio to the ground slope, as suggested by Messrs. Thompson and Davey in their paper. Further study of this proposal is needed, to be sure that the presumed advantages of the standard deviation method would actually prove to be so in practice. One difficulty that may arise with this type of specification is the chance for difference of opinion between the map maker and the map tester on the degree of ground slope. In fact, ground slope is probably indeterminate on saddles, summits, depressions, vertical curves, irregular slopes, and so on.

It might be that we really need to apply the tests in two different ways, for two different purposes—one for determining acceptability of the final map, the other for scientific research in appraising compilation techniques and instruments. In other words, the present specifications and test results may prove to be better for determining compliance or non-compliance of each map with minimum requirements, but the test results based on standard deviation, with tolerance varying according to ground slope, may be superior for such purposes as studies related to optimum *C* factor. The field tests could be made in identically the same manner for either type of specification—the difference would be in the analytical comparisons between test data and map data.

There is one other point which the specifications might well cover, and that is the relative accuracy of contours, or the accuracy of each contour with respect to adjacent contours. This has a great effect on the quality of the map. One map could be so bad in this respect as to be unacceptable, and another could be excellent; yet both maps would be rated the same so far as the present accuracy standards are concerned. In the Geological Survey this is handled as a matter of appropriate topographic expression. It is interesting to note that the British Ordnance Survey requires the actual interval between adjacent 25-foot contours to be (approximately) not less than 20 feet, or more than 30 feet, which is a relative tolerance of one-fifth interval.

Question 6.—Are the United States specifications for contour accuracy more stringent or more lenient than European specifications?

Answer.—As was indicated in the Thompson-Davey paper, our United States specifications for contour accuracy are not as stringent as the English, French, or German specifications. However, it may be that the ultimate effect is about the same because of an apparent tendency in the United States to use a smaller contour interval for maps of comparable scale.

Question 7.—Should the United States specifications be made more stringent for flat terrain? In other words, is the half-interval tolerance really good enough for widely-spaced contours in flat terrain?

Answer.—All topographers naturally tend to locate the individual contours in flat terrain with much greater accuracy than the half-interval tolerance, particularly where the contours are being surveyed by planetable. This has been traditional in the Geological Survey for many decades, and is believed to be economi-

cally justified. Inasmuch as we do it anyhow, the practice should be rationalized and made more uniform by some modification of our specifications. However, in gently sloping but irregular-featured terrain it is difficult to apply a closer tolerance than one-half interval for randomly located test elevations that are to be compared with elevations interpolated from the contours of the map. It would, of course, be practical to specify a closer tolerance for the contours themselves, by requiring the position of each contour on the map to be within a certain horizontal distance, or a certain vertical distance, of correct position. While this might provide more reliable elevations in the immediate vicinity of each contour, it might often happen, on "flat" terrain having irregular slopes between contours, that interpolated elevations would not be reliable to anything closer than one-half interval. In regular sloping terrain there is, of course, no problem with either type of specification.

It should be noted also that when *supplemental* contours are used in flat areas there is less reason for extraordinary accuracy in contour position. For example, suppose the map has a basic interval of 10 feet for the hilly terrain, with a provision for use of 5-foot supplemental contours for "flat" slopes. Obviously 5-foot contours that will yield elevations correct within one-half interval should be just as useful as 10-foot contours that will yield elevations correct within one-quarter interval.

It may be that contours alone cannot entirely supply the information necessary for flat terrain. No doubt many of us are familiar with areas where spot elevations are actually more helpful than contours. Perhaps, for such terrain, the specifications should provide for use of strategically located spot elevations, accurate, say, to the nearest foot.

Question 8.—Do the United States standard specifications for contour accuracy need modification for steep slopes, when the interval is such that the contours become crowded on the map?

Answer.—As demonstrated in the Thompson-Davey study of 1952, the allowance for an imaginary shift of any contour of one-fiftieth inch in any direction of 1:24,000 scale maps seems to take care fairly well of the larger tolerance that is desirable for steep slopes. For example, where the slopes are such that the contours are spaced at 20 per inch on 1:24,000 scale maps, the tolerance is actually 0.9 interval, or, for all practical purposes, a full interval.

However, we frequently have even steeper slopes, requiring that the intermediate contours be so closely spaced that they tend to coalesce and become mere symbols of steepness, with the result that only the accentuated contours remain distinct and discernible. Even for such slopes the map would comply with the standards, under a common-sense interpretation of the specifications, if each index contour were in correct position on the map within the allowable horizontal tolerance for the map scale. This means that, on map scales smaller than 1:20,000, each index contour is satisfactory if it is located anywhere within a band 1/25 inch in width; for maps at scales larger than 1:20,000, the band is 1/15 inch in width. As stereoplotters are at their best in steep terrain, these tolerances should not be difficult to attain, provided appropriate procedures are used.

Question 9.—On special-purpose maps is there any reason for adopting contour-accuracy criteria that are different from the United States standard specifications?

Answer.—Yes, there may often be good reasons for specifying greater accuracy than the half-interval, especially where the terrain is extremely flat. However, there rarely should be reason for adopting tolerances larger than the conventional half-interval. It should not be difficult to demonstrate to a client who is accustomed to 5-foot contours having only full-interval tolerance, that 10-foot contours with half-interval tolerance would be just as useful, and also would usually be cheaper.

Question 10.—How many different classifications of contours are generally recognized in the United States, and how can these be differentiated from each other for the benefit of both map users and map revisers of the future?

Answer.—There are at least four categories of contours recognized generally by topographers, as follows:

(1) Standard, or standard-accuracy, contours are intended and expected to have a *minimum* accuracy of one-half interval for 90 percent or more of the map's area, plus the usual "contour shift" allowance. Standard contours are drawn in full lines, with every fourth or fifth contour accentuated to serve as an index contour. Each map sheet that has standard-accuracy contours should carry a marginal note to that effect, in accordance with current practices.

(2) Supplemental contours, sometimes called auxiliary contours, should always have a mini-

mum accuracy of one-half interval. Supplemental contours should be utilized only to show additional topographic detail in the extremely flat terrain of an otherwise hilly or mountainous sheet. They should be differentiated from standard contours by being shown in dotted lines. Supplemental contours should be used only in conjunction with standard-accuracy basic contours.

(3) Approximate contours are of a considerably lower order of accuracy than standard contours. There is some precedent (on certain recent contracts for large-scale maps) for a *minimum* tolerance of a full-interval, but an *average* tolerance of a full interval might be more appropriate. Where the entire map sheet is composed of approximate contours, they could conveniently be shown as full lines in the same manner as standard contours, but where a sheet shows both standard and approximate contours, the latter should be shown in broken lines of short dashes for the purpose of differentiation from standard contours. Maps showing approximate contours only could be identified by the omission of the standard-accuracy note, or, better, by a note defining the probable contour accuracy if this is known. Where the source data will not yield approximate contours having as a minimum an *average* accuracy of about a full interval, it would seem to be better either to increase the interval, or to use form lines or other treatments such as hachure shading or hill shading.

(4) Form lines, which resemble contours in general appearance, are occasionally used to indicate the general size and shape of major topographic features. They should not be used to indicate topographic elevations, although elevations of prominent topographic features, where known, may be indicated by the use of spot elevations. Form lines can be distinguished from contours by the absence of contour numbers and accentuated index lines, but complete distinction from both standard contours and approximate contours could be achieved by always showing them in broken lines of long dashes.

This concludes my review and discussion of this important subject of contour intervals. I respectfully refer all these questions and suggestions to the Topography Division of the ACSM for further study and consideration. I don't know of anything that that Technical Division could do that would be of more benefit to our profession than to undertake full-scale investigation and debate of these basic policy matters, in an effort to determine the consensus of all major groups, including the important map users.

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"The Surveyor's Notebook—Series Two"

"The Surveyor's Notebook—Series Two," a collection of short articles on unusual surveying problems and their solutions, has been published recently by W. & L. E. Gurley, Troy, N. Y., 108-year-old manufacturer of engineering and scientific instruments.

Relating actual field problems and their solutions, the stories and surveying tips are told in the surveyors' own words.

The stories in the collection are new. Demand for the first year's series, published early in 1952, was so great that three printings of the booklet were exhausted within a year.

Among the stories in Series Two are experiences in surveying the Antarctic; methods for eliminating errors in precise alignment; and a discussion of how to cut down weather problems in the field.

One page shows how to subdivide 50,000 acres into nearly 200 lots in accordance with the rights of 600 people. Another tells how one field man brought in stations in the muck of the Red River Valley.

Among the surveying tips included in "The Surveyor's Notebook" are recommendations on the use of the gradienter; the method for using a level on a tractor for whipping mud flats; and a system of determining in the field, without calculation, whether or not a survey will close.

Also described are ways to get more out of a compass, and new sources of income for the surveyor, who can be called in on alignment jobs *inside* industrial plants.

Copies of "The Surveyor's Notebook—Series Two" can be obtained free of charge from W. & L. E. Gurley, Troy, N. Y.

Local Control Aids the Property Surveyor

By H. J. McFARLAN

ASSISTANT PROFESSOR OF GEODESY AND SURVEYING, UNIVERSITY OF MICHIGAN

THERE is a bronze plaque at the University of Michigan in memory of the late Prof. J. B. Davis, who organized one of the first camps for the teaching of surveying in 1874. On this memorial one of his characteristic sayings is quoted: "Young man, when theory and practice differ, use your horse sense." I have had this admonition constantly in mind while preparing this paper. As I now face so many practicing surveyors, my hope is that in the next few minutes they will not be reminded of that significant definition which says: "Horse sense is the kind that a jackass doesn't have."

A surveying teacher does not have much chance to get practical experience. He may make, however, an occasional survey. In doing this he does not get the experience that comes from having to satisfy his clients, and maintain an organization on a continuing basis. The very nature of the situation inclines him to be theoretical in these practical matters. Yet, it is one of his major obligations to investigate new technical ideas and evaluate new applications of old ones.

Let us start with some definitions. The verb "control" means "to check, test, or verify by counter or parallel evidence;" and the noun means "a standard of comparison or means of verification." Surveying teachers constantly emphasize to their students the importance of the principle of control as indicated by these simple definitions. The graduates who enter surveying practice acknowledge that the college instruction has been effective because they constantly use some form of control in their every-day activities. Why then should a teacher appear at a national conference of practicing surveyors to discuss the advantages of the use of horizontal control? To be frank, it is because surveyors have not learned their lessons as well as could be desired. They only partially understand and appreciate the importance of the general principle which they have been taught. Far too many are neither familiar with nor using all of the "means of verification" which are readily available to them. By failing to take the greatest possible advantage of the fundamental principle of control, they are neglecting one of the best ways of increasing their surveying efficiency.

That part of the public which owns real estate has reason to be dissatisfied with the quality and the cost of surveying service. Property descriptions based upon poor surveys are responsible for a vast amount of litigation, and clients are constantly penalized because of the tangled situations which surveyors must unravel. There are few city areas for which it can be said that lines on the ground are very nearly as they are described in record titles. The average client is unable to appreciate that the unfortunate consequences of faulty surveying usually do not appear until long after a survey is completed, and that many of his troubles have come out of the past. He naturally believes that the resurvey charges are excessive. Laymen neither can realize how much time, labor, and judgment their surveying problems require, nor why different surveyors may not agree upon the location of a boundary line. Without an understanding of the situation, they are likely to suspect unreasonableness in the charge for services, or incompetence, or both. It is the responsibility of today's surveyors to minimize the costs which result from past work and to initiate practices which will elimi-

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nate the perpetuation of confusion. If they are to gain and merit recognition as professional men, they must increase their efficiency by using methods which will result in property surveys of permanent value.

The tendency among surveyors has been to emphasize increased accuracy as the means of improving the practice of surveying. Few realize that this is not enough. Imagine that somewhere could be found a dozen or more traverses within a single square mile which were made with suitable accuracy, but were independent and unrelated as to orientation and location within the areas. Then visualize the effort which would be required to get a reliable survey pattern of the area by assembling the data of such surveys. A little reflection should lead to the conclusion that the interrelation of independent surveys is necessary in addition to suitable accuracy if they are to constitute component parts of a systematically organized whole.

The increased use of horizontal control, such as that of the U. S. Coast & Geodetic Survey, would not only result in orderly over-all surveys, but would also provide the practical means for significantly increasing accuracy. It is impossible to determine reliably the accuracy of a single independent survey except by expensive, and therefore impractical, repetition. It is true that the proper techniques required to minimize error are well known, but it is not possible to determine whether they have been successfully used on a particular survey except in "checking by counter or parallel evidence." The too common practice of considering relative closure as an indication of accuracy is not dependable, because those procedures resulting in low accuracy may still give good closures if they are used consistently. Estimates of accuracy are likely to be too high and too uniform if they are based upon closures. If, however, a traverse is run from one higher-order control point to another, closure is a relatively sure and reliable measure of accuracy.

The accuracy which it is practicable to specify cannot be chosen unless the extent of a survey is known. It depends also upon both purposes and available funds. Actual displacements of points and lines determine if the purpose of a survey is served, and these depend upon the extent as well as the accuracy of the survey. Separate surveys are combined in many ways and for many purposes that cannot be anticipated. If comprehensive horizontal control is not used, the errors in the separate surveys are expanded and compounded indefinitely in the combinations. Therefore, the specification of accuracy for the components is meaningless. The propagation of errors is minimized by ties to control points of known position. Greater use of control would reduce the uncertainty about accuracy which is frustrating to so many surveyors.

Plane rectangular coordinates are closely associated with surveying calculations and maps. Whether plotting data on a sheet of paper or expressing positions of survey points, their use makes possible a systematic expression of relationships.

The advantages of extensive use of horizontal control have been demonstrated in local projects and on a city, State, and Nation-wide basis. The achievements of the U. S. Coast and Geodetic Survey provide a good example. The manner in which this agency has executed first- and second-order triangulation illustrates how a thorough application of the principle of control results in maintaining high quality and reducing costs.

Systems of local plane coordinates have been used on many construction projects and large industrial and institutional layouts. Investigation and comparison show that where such a system has been used, surveys are more satisfactory, records are simpler and more complete, and costs are lower than in those areas where it has not been used.

In geodetic surveys, measurements are projected upon the earth's mean sea level surface. Arc lengths and angles of spherical triangles on this spheroidal surface are determined. Latitudes and longitudes are computed from them, and the positions of points are given by these spherical coordinates. Where horizontal control is used in

city work, a common practice is to compute plane rectangular coordinates for these geographic positions. This computation is accomplished by projecting the points upon a plane tangent to the spheroid at the center of the survey area. The errors in the rectangular coordinate positions caused by projecting from the spheroid to the plane are made practically insignificant by limiting the size of the control survey.

Published discussions of such city surveys have properly included consideration of theory and the descriptions of field operations and computation procedures. The average surveyor, however, does not understand the technical aspects of these subjects. This lack of comprehension has tended to prevent him from becoming interested in horizontal control. It has caused him to develop the idea that it is something fancy and complicated which can be used in certain situations by a few theoretical and highly skilled men. This reasoning is probably responsible for the slow recognition of the importance and values of horizontal control.

Actually, the use of city coordinate control is not difficult. Practically nothing is involved which is not well understood by those who do surveying and use plane coordinates. It is not necessary to understand how such coordinate values are initially obtained. In the field it is only necessary that traverses be run from one higher-order control point to another. Orientation is accomplished by sighting upon another control station or upon an azimuth mark. The angular closure is determined by a similar procedure at the closing control point. Ordinarily, the angular error is distributed among all the angles. The corrected angles, or directions, are used for computing latitudes and departures. The errors in latitudes and departures are the amounts by which their summations vary from the differences of the coordinates of the control points. The relation of the error of closure to the length of the traverse reliably indicates its accuracy.

Twenty years ago, the North Carolina Highway Department realized that poorly monumented level surveys, arbitrarily referred to various level datums, caused the waste of much money. It was also observed that there were many precisely located triangulation stations that might be used for horizontal control purposes, except that the position data for these stations was not in a form that highway engineers could use. For a solution to the second problem an appeal was made to the Coast and Geodetic Survey. This inquiry prompted studies which led to the development of the North Carolina State Coordinate System. The Coast and Geodetic Survey developed a means for projecting points distributed over large areas onto surfaces that could be developed onto planes without large distortion in the projected positions. It determined that plane coordinates could be computed with distortion not exceeding 1/10,000 for points lying within zones up to 158 miles in width. It was decided that this ratio constituted a practical limit for distortion and all of the States were divided into zones not exceeding this width. The Coast and Geodetic Survey also devised a method of correcting for this distortion. The result is that we now have State coordinates for over 40,000 triangulation stations and 100,000 intersection points such as chimneys, tanks, spires, etc., in the United States. The State Coordinate System is the means by which local surveys may be used to extend the network of horizontal control for the entire country.

State coordinates are plane rectangular coordinates. They may be used in the same way and for the same purposes as other types of control which have been proven to be so valuable. They provide control for much larger areas than do local or city systems. Since State coordinates have been available, it has become unnecessary and generally undesirable to develop independent local coordinate systems. State coordinates are being used extensively in several States, and the advantages to the property surveyor are being demonstrated. Surveyors in Massachusetts, Connecticut, and New

Jersey are especially active in their use.

It is not suggested that all surveyors should immediately start using State coordinates for all of their surveys. That would be absurd. The 140,000 points are too widely separated throughout the country to make this practicable. In Michigan, for instance, they are spaced at about 25-mile intervals. However, all surveyors should know how to use State coordinates and should do so whenever reasonably possible. More than that, they should become enthusiastic about them and encourage their utilization. It is almost certain that savings would result from their use by highway departments and other organizations which are engaged in making route surveys, because checks for such surveys could be had without running closed circuits.

Local horizontal surveys are based upon State coordinates and are permanently monumented; they may serve to increase the number of control points available for the use of all. The result is that traverses connecting newly-set control points become shorter. Decrease in the length of traverses permits the use of less precise methods with consequent reduction in costs. The more points there are available, the more coordinate control can be used, and the greater are the resulting economies. Once the start is made, a chain reaction develops. The Coast and Geodetic Survey has made the reconnaissance and staked the preliminary line for the road to surveying progress. It will undoubtedly continue with related tasks but the bulk of the work of developing local control must be done by other agencies and private surveyors. Every proper use of control extends it. Every extension makes possible more profitable use. When the surveyor achieves a good understanding of the State Coordinate System, he is likely to utilize its advantages.

There are many opportunities for the private surveyor to promote significantly the use of local horizontal control. Let me give you an example. The University of Michigan has recently acquired about 267 acres on which to carry out an expansion program. Those responsible for directing the development were persuaded of the desirability of monumenting a 500-foot grid on this area. The advantage of this kind of project control was recognized. Before starting, they became curious as to how much it would cost to connect these monuments to the State Coordinate System. Upon investigation it was found that there were at least seven State coordinate points (from one to more than five miles away) which were visible from the roof of a new Federal hospital across the road from the area. By the three-point method, State coordinates for a point on the roof were determined. From this point a State coordinate position and a grid azimuth were transferred to the ground. Concrete monuments now mark the even 500-foot State coordinates on this area.

This type of possibility should be kept in mind by those interested in using control when it is feasible to do so. Was this monumentation expensive? It cost only a few days of work. Was it worth the price? Coordinate control usually is. The location of a building, sewer, or any other structure can now reliably be made with no single measurement exceeding 250 feet. Also, it is now possible to take advantage of the merits of a coordinate system in keeping records.

Every land surveyor worth his salt constantly profits by the use of the principle of control. In fact, control is so important that it may be said that surveying is dependent upon its use. With State coordinates available, surveyors now have at their disposal a practicable means of extending the use of this principle so valuable to them. By tying separate surveys and project and city control systems to State coordinates, every surveyor in a coordinate zone may cooperate in contributing data which may be integrated into a permanent over-all survey for the entire area. It is predictable that more extensive use of all kinds of horizontal control will improve the quality of surveying. As land surveyors increase their efficiency by the use of horizontal control, they will merit and probably receive recognition as truly professional men.

Copyright and Registration of Maps

By A. L. KAMINSTEIN
CHIEF, EXAMINING DIVISION, U. S. COPYRIGHT OFFICE

IN VIEW of the wide use of maps today and the yearly output of maps, it is a little surprising to find that only 2,422 were registered in the Copyright Office during the past fiscal year.

This is no doubt partly due to a lack of understanding as to how to protect maps or to the supposed difficulty of doing so. The steps necessary to secure protection for them by way of copyright are really quite simple; however, they are technical and must be taken with care.

An author is entitled to protect anything he writes which is original with him, and the cartographer is similarly entitled to protection for original map work. He secures such protection automatically, as soon as he has put his work on paper. This is common law protection, and it requires no further action on his part—no registration, no copyright notice, no formalities of any kind.

Common law protection is simple and comprehensive. There is one danger however: as soon as copies of the maps are placed on sale, sold, or publicly distributed, the map is stripped of its common law protection. At that moment, the map secures statutory copyright if the copies bear the required copyright notice, but all copyright is forever forfeited if the copies do not bear the notice.

If the first edition of a map is published with no notice or with an inadequate notice, it is not possible to correct the defect in a later edition.

STATUTORY COPYRIGHT

There are three distinct elements in any usual copyright notice, such as "Copyright 1953 by James Wilson," and they are:

The Magic Word	*The Year Date*	*Your Name*
Copyright	1953	James Wilson

(1) *Magic word.*—In the case of maps without text matter, you have a choice. You may use the word "Copyright," the abbreviation "Copr.", or the symbol, "©". Don't use other abbreviations; like other magic formulas, other words that look or sound as good won't work. If it is more than just a map, and there is important text material or pictorial illustration with it, it will be safer to use "Copyright," or "Copr."; rather than the symbol "©". For usual map material alone, you may wish to minimize the copyright notice, and you may use the symbol © accompanied by the initials of the owner, but in that case, the full name of the owner must appear elsewhere on an accessible portion of the copy.

(2) *Year date.*—The year date is required only on "printed literary, musical, or dramatic works," and it may be omitted completely on maps without text. If there is any possibility that the particular map comes within the above classification, use a year date, which should be the year in which the work is published, not the year of preparation or printing.

(3) *Name.*—This should be the first and last name of the owner of the copyright. If you hired someone to draw the map, your name—not his—should appear in the notice.

One further precaution. The notice should appear on the face of the map, and although it need not appear in large print, it should be big enough to read with the naked eye.

DATE OF PUBLICATION

We have seen that statutory copyright is secured when copies are placed on sale, sold, or publicly distributed if the copies bear the statutory notice. This moment is called the "date of publication." Printing is not publication. Unrestricted display of a map at a museum or exhibition might be.

It is almost impossible to define publication so as to cover all the conceivable situations. There are some situations which definitely amount to publication, and these include: distributing or offering copies to

the general public, and printing a map in a newspaper. Other situations ordinarily do not constitute publication, e.g., offering your original manuscript copy to a publisher for purchase, or circulating the manuscript copy to friends for criticism. There are a great number of borderline situations. The distinctions are quite hazy and, as a matter of precaution, it might be well to place the required copyright notice on your work before you do anything which might amount to publication.

WHAT MAPS ARE PROTECTED

So much for *how*. Let us now consider whether the map need appear in any set form and which maps can be protected by copyright. There is no one form of map for copyright purposes. Your map may be historical, pictorial, or devised as a guide for touring. It may appear as an atlas, marine chart, globe, or relief model.

We will assume that most maps are like the plots of most books, and that it is very rare that we will find a completely new kind of map. Most maps will be a combination of something old and something new. The copyright law does not expect a map to be the result of a flash of inventive genius, but it will not protect anything which is not original with the cartographer. Original in this sense does not mean completely different from anything done before; it means that it originated with the cartographer and was not copied.

Let us assume that you superimpose on an outline map of a State a government rainfall chart for the same area. In addition, you now add contour lines showing eroded areas, based upon your own original research. Copyright will protect the new contour lines, but it will neither prevent anyone else from using the same maps you did, nor from using a system of contour lines as long as they do not copy your map. This does not mean that it is safe to copy someone else's system; it may be covered under some other form of protection.

"Original" should also be distinguished from "new." You may create a new map by placing existing maps of two contiguous countries together. This would be little more than a mechanical operation and the courts might not protect it. The general guide to remember is that the more original the map is the more likely the courts are to protect it.

The Copyright Office is frequently asked if it checks to determine whether a map is really new or original. It does not, and a moment's consideration will indicate the impossibility of comparing each new map with all the maps drawn since the beginnings of cartography.

When your map is your own work and you wish to protect it, simply put the statutory notice on it when you publish it. You do *not* need the permission of the Copyright Office in order to do this.

REGISTRATION

Your copyright protection begins when you publish with the required notice, but there is one more step to be taken before you will be able to enforce your rights. You must secure a certificate of registration, and in order to do so, send two complete copies of the best edition of the map to the Register of Copyrights, Library of Congress, Washington 25, D. C. These should be accompanied by an application on Form F and a fee of $4.00.

The law provides that the Register of Copyrights may demand the deposit of copies of any work published with notice together with a claim of copyright. A claimant may lose his copyright, subject himself to a possible fine of $100 and be required to pay to the Library of Congress twice the amount of the retail price of the best edition of the work, if, after the Register notifies him that he wishes the copies deposited, the claimant fails to deposit them.

REVISED EDITIONS

It is also possible to make a new registration for a map which has been completely revised. Minor changes would not require another registration.

The registration procedure is simple and prompt. If there are no problems, most

applications are entered and the certificates mailed to the applicant within the course of a week or two.

The term of copyright is 28 years from the date of first publication, with an additional 28 years if the work is renewed by filing application in the Copyright Office in the 28th year.

Ode to an Engineer

With clouding wits the draftsman sits
And pushes pens and pencils
While day by day the years slide 'way
Among his prints and stencils.

He never shirks his tiresome work
He couldn't do without it
And if he stops, asleep he drops
And then he dreams about it.

And every day in the same old way
He carries out his duties
With never a glance for gay romance
And blind to all their beauties.

And when some day he'll pass away
There'll be no change to show it
For engineers are dead for years
Before they ever know it.

—*The Engineers' Bulletin*, January 1952.
(The Colorado Society of Engineers)

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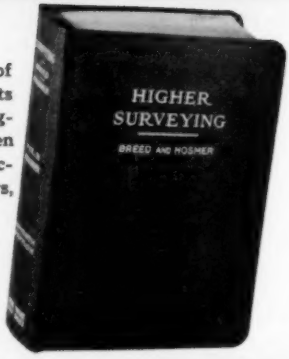

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Please Write in Ink

By FRANK L. REMINGTON

SOME YEARS ago the residents of an Arkansas village voted on a suitable name for their local post office. Beneath the blanks in which they were to write their choices was the request, "Please write in ink." Taking the instructions literally, many of the voters dutifully wrote "Ink," and so the town took that name.

Post offices, as well as towns, rivers, and mountains, often acquire their names through misunderstanding, humorous circumstances, and local legends. There are thousands of places with such bizarre names as Double Trouble, Gouge-Eye, Muletown, Zigzag, Wounded Knee, You Bet, Birthright, Burnt Corn, and Sleepy Eye. Each has its own individual story. There's even a Nameless, Ga., so called because the residents could not reach a decision on a suitable title, but finally agreed to leave it Nameless.

The Post Office Department rejected the first two names submitted by a Missouri settlement. "Why don't you choose a name peculiar to your vicinity?" the Department asked. In exasperation, the citizenry decided to call it Peculiar. The founding fathers of another village wanted a singular name for their post office and got it—Odd, W. Va.

To act as a central clearing agency for place names, as well as to minimize the confusion of travelers, map makers, and the Post Office Department, President Benjamin Harrison in 1890 set up the Board of Geographic Names (BGN) as a sub-division of the Interior Department. Before that time local partisans often had several names for their community, each one having its adherents. In addition, spelling caused some difficulties. Indeed, it was not uncommon for an unusual place name to have a dozen different spellings. Post offices, too, righteously complained that several or more towns within their state had the same name, thus unnecessarily delaying mail deliveries. Even today there are 121 American towns named after Washington and 33 after Franklin.

For the past 62 years the Board of Geographic Names has straightened out these difficulties. Of course, the Board encounters a peck of trouble in dealing with local prejudice, but in spite of this obstinacy it is doing a first class job.

Among its functions, BGN members sit in judgment on the various names submitted for a new place and act on applications for changes in an old one. It also arbitrates disputes as to which of several names should be the official one. Only recently, the citizens of Truman, Tex., petitioned to change the town's name to MacArthur. When the request failed, a number of disgruntled residents asked the neighboring town of Mesquite to annex them. Then there was the case of a stream in Hillsboro County, N. H. Regional tradition insisted that it be called Quohqinapassakessamanagneg. The Board, however, settled for Beaver Brook. Once BGN approves a name, it is used on all maps and documents.

The Board's judgments involve everything from spellings and pronunciations to hyphens and apostrophes. Some years ago, harrassed Board members attempted to standardize the spelling of the three counties and ten post offices that bore the name of Vermilion or Vermillion, finally deciding on the single "l." The enraged citizens of the various Vermillions, however, would have none of it, and BGN finally gave up in despair.

It fared a bit better, though, in the case of a tiny neck of land on the East River in the Bronx. The disputed location had been called variously Cornell's Neck, Clauson's Point, Clawson, Clauson, Clason Point, Classon Point, and Clason's Point. Fortunately for the Board's peace of mind it had ample evidence that Clason Point was the most popular.

Reprinted through the courtesy of *Pen*, March 1953.

Actually there are as many stories behind the selection of a place name as there are names. Often the name-givers take their cue from the obvious. Thus, Haystack, Ore., acquired its name from the most prominent object on the landscape. Flagstaff, Ariz., took its title from a trimmed tree to the top of which a party of explorers hung a flag to celebrate the Fourth of July. And Zigzag, Ore., naturally was named after the irregular shapes of the mountains among which it nestles.

Many place names fall into natural categories, such as Tomato, Ark.; Toast, N. C.; Biscuit, Ky.; Sandwich, N. H.; Tea, S. Dak.; and Coffee, Ga. In the military there's Soldier, Kans.; Cannon Ball, N. Dak.; and Torpedo, Pa.

In a religious vein, there's Providence, R. I., named by Roger Williams in gratitude for the Divine guidance which led him through the wilderness to a new home. Faith, N. C.; Hope, Kans.; and Charity, Mo., also reveal a pious turn of mind, while Methodist, Baptist, Priest, Pope, Friar, and Tabernacle, all in Tennessee, reflect denominational preferences. The Tennessee towns of Alpha, Beta, and Omega, of course, have their origin in the Greek alphabet.

Not infrequently the Board of Geographic Names receives requests from individuals who wish to apply their own names to a village, river, or mountain. Usually the Board refuses such requests, preferring not to apply the names of living persons to locations or natural features. A living person, BGN reasons, might ride a crest of popularity only to fall subsequently into ill repute. The town named in honor of such an individual would start a campaign to change its name. Since it has no hankering to change its decisions every few years, the Board frowns on so honoring living individuals. Of course, there are exceptions, such as Gene Autry, Okla., and West Virginia's Nimitz and MacArthur.

Family names, given names, and even initials, however, are popular. Take Morrowville, Kans., named after a State Senator. At first, the place was called simply Morrow. The railroads quickly added the "ville," complaining that passengers asked for tickets "to Morrow," thereby confusing the ticket sellers.

Marvin, S. Dak., resulted from a heated dispute. The city fathers could come to no agreement on a town name until one of them noticed the name Marvin on a safe. "Let's call it Marvin," he suggested, "after all that's a good safe name."

In Oregon there's an Elmonica, named in honor of two of the town's girls—Eleanor and Monica. T. B. may be synonymous with a dread disease, but in Maryland it's also the name of a small village, after the initials of Thomas Brooke, once a wealthy land-owner of the vicinity. Itmann, W. Va., combines both the initials and name of I. T. Mann, a local bigwig. Other places prefer backward spelling. Sniktaw, Calif., is Watkins in reverse, and Reklaw and Sacul in Texas are the backward spelling of Walker and Lucas.

The Post Office Department can select a name for a new post office or change an old one without approval from the Board of Geographic Names, unless, of course, it's a name on which BGN has already acted. New communities petition the Postmaster General for a post office, usually submitting a list of tentative names. "Wewanta post office," the residents of a West Virginia village wrote him. And he obligingly gave them one—Wewanta.

There's really no telling what bizarre circumstances go into the selection of a place name. Take Novi, Mich. In the old days a stage-coach ran between Detroit and Lansing, making a dozen or so rest stops at intervals along the way. Signs with Roman numerals indicated the numbers of these comfort stations. In due course a town sprang up around stop No. VI. Taking their cue from the numerals on the sign, the residents dropped the period and the place became simply Novi.

Bakeoven, Ore., acquired its name in an equally unique manner. A French trader set out one day with a stock of flour. Ill luck plagued him, for on his first night out a band of marauding Indians raided his camp and stole his mules. Without trans-

portation for his merchandise, the ingenious trader constructed a stone oven on the spot, baked his flour into bread, and sold it to passing trappers and travelers. Later, settlers in the vicinity remembered the incident and dubbed their community Bakeoven.

Even the railroads have had a finger in this name-giving business. A railroad station in Oregon happened to be the location of its division's watering tanks, so the place was christened Tanks. Similarly, a coaling station in California became Coalinga, the residents adding the final "a" for good measure. When the Milwaukee Railroad built a bridge across the Missouri River some years ago, a telegrapher stationed at the site signed his messages "Missouri Bridge." Later he shortened it to "Mo. Bridge," which eventually became Mobridge, S. Dak.

A landslide along the right of way in Washington State prompted a railroad laborer to comment, "There'll be hell to pay." Consequently, the construction workers called their camp "Hell to Pay." Later, town residents softened it to Eltopay, and eventually to Eltopia.

Even business firms have had a part in putting names on the map. An abbreviated spelling of Aluminum Company of America, Alcoa, a town in Tennessee, is the home of a huge aluminum plant that employs more than 8,000 people. Likewise, Atco, Ga., is a short form of the Atlantic Transportation Company.

Colstrip, Mont., reflects the industry of that site—strip coal mining. Gloversville, N. Y., is the site of numerous glove manufacturing concerns. Similarly, such names as Oil City, Oil Center, and Petrolia, indicate the industrial proclivities of those districts.

There are even places named for radio programs and comic strip characters. Soon after the residents of Hot Springs, N. Mex., participated in the popular broadcast, Truth or Consequences, they voted to change the name of their town to Truth or Consequences in honor of the occasion. The constant bickerings of the folks in a small Nevada village so reminded them of the domestic squabbles of Maggie and Jiggs, the comic strip favorites, that they decided to call the place Jiggs.

Another village, this one in New York, also inherited its title from the wranglings of the early settlers, most of whom migrated there from Pennsylvania and New England. A dispute raged between these partisan groups, each of whom wished to give the town a name that would remined them of their old homes. So heated did the argument become that neighboring communities called the place Pandemonium. But the residents themselves finally resolved their differences by naming their settlement Penn Yan—Penn for the Pennsylvanians and Yan for the Yankees from New England.

Show Low, Ariz., also has a unique history. In the old days of the West, disputes were usually settled by the pull of a trigger. or, if the parties involved were more friendly, they might sit down to a game of cards to settle their differences. Deciding to go their separate ways, two ranching partners, in 1881, sat down to a game of seven-up, the winner to take over the ownership of the ranch and the loser to move on to greener pastures. Tiring of the game, one of the players declared: "If you can show low, you win."

"Show low it is," his partner cried, turning over a deuce. And Show Low it has remained from that day to this.

The stories behind many place names are, no doubt, based on word-of-mouth legends and tall tales. One story has it that Sheboygan, Mich., derived its name from the disgusted remark of an Indian Chief when his squaw presented him with another daughter—"She boy 'gain!" This story probably stretches the truth, as does another tale concerning the name of Lake Elsinore, a mineral lake in Southern California. A Spaniard in the early days, this one goes, rushed into the lake and gulped down huge draughts of water. Asked by an American how it tasted, the Spaniard replied: "Like 'ell, senor." And so Lake Elsinore was named.

Mussels With Muscles

QUESTION: Shouldn't Muscle Shoals be called Mussel Shoals? It seems so to me but I can't find any backing.

ANSWER: We turned this inquiry over to our personal Washington correspondent, who replied: "A knothead cartographer in the Interior Department here never heard of mussels, and with Jack Dempsey in mind, on his map of the region he spelled it the kind of muscles Dempsey had. Many a mussel shell I have picked up on the Ohio River beaches more years ago than you can remember. Muscle Shoals was originally made by the little muscles of mussels."

FURTHER REMARK BY H. D. BUMP: We deplore any flippancy about the muscles of the Manassa Mauler. We saw him the other day and his muscles still look too good for it to be wise to engage him in combat. Maybe you are in better condition.

—Quoted from "The Proofroom," by H. D. Bump, a regular feature of the *Inland Printer*, March 1953.

* * * *

The Inland Printer
Editing Department
309 West Jackson Boulevard
Chicago 6, Ill.
Attn: H. D. Bump—The Proofroom

Sirs, and Madam:

It would of course happen that the *Inland Printer* would choose to print descriptive terminology concerning the cartographer just at the time ACSM's Division on Cartography was in annual session. We refer of course to your use of "knothead" on page 46 of your March 1953 issue of the *Inland Printer*. May we suggest you deplore the flippancy further than your stated concern with Jack Dempsey's muscles. Shades of Teall the elder and Teall the younger, as well as J. L. Frazier the present. Such public relations! Deplorable is right.

It would seem that *Inland Printer* got involved with an "inland waterways" problem—a shallow water problem, and waded out a bit deep. It so happens that both *muscle* and *mussel* come from the Latin *musculus* and carried out far enough comes out *muscle*. But that is knot our quibble. The matter is a nautical one, probably the reason your Washington correspondent had "knots" in his head—and the cartographers that deal with knots are not in Interior Department, but over in Commerce or Navy. You see how these name-calling affairs get involved. Do you think you are helping Ike get his Cabinet all straightened out, starting a rumpus like this? If you ever get such an inquiry again, try to remember that the official name-calling agency of Uncle Sam is the Board of Geographic Names. That agency, while perhaps not interested in the Manassa Mauler's muscles, would probably explain that Muscle Shoals was named before the Mauler had muscles. They might even convince you that the shoals were more famous for the muscle required to pole barges off of them, than for the mussels that put the barges on.

Ah! Yes—I can hear you now, saying "It would be ACSM's Thirteenth Annual Meeting."

Howsomever, rest assured that more cartographers now know of the *Inland Printer* than ever didst before, believe it or knot.

Cordially,

WALTER S. DIX, C.E., L.S.
Executive Secretary, ACSM

Zero

There's no such thing as nothing:
It's just a term we choose
To designate an utter void,
That Nature does not use.

Our minds are much too shallow
To grasp how it can be
That what had no beginning
Ends in eternity.

—VELMA WEST SYKES, *The Scientific Monthly*, August 1952.

Alaska Mapping Programs and Needs

(A Symposium)

The following eight papers were presented at the Third Alaskan Science Conference, Section on Geology and Geography, in September 1952 at McKinley Park, Alaska. Kirk H. Stone was Chairman of the Section.

—EDITOR

Bases for Alaska Mapping

By KIRK H. STONE

ASSOCIATE PROFESSOR OF GEOGRAPHY, UNIVERSITY OF WISCONSIN

A BASIC PROBLEM in any part of the Northern Lands is its geography, i.e., its location. So it is in Alaska; not only the position of Alaska with respect to the rest of the world but the position of the various parts of the Territory with respect to each other. These locational relations are best portrayed on maps. Thus, maps are basic in Alaska, basic to both the scientific and lay populations.

In recognition of the fundamental need for maps of Alaska, a resolution about them was passed at the first Alaska Science Conference in 1950. This resolution was: "That current mapping programs for Alaska, including topographic and planimetric mapping, charting of coastal waters, aerial photography, and geodetic surveys, be speeded up in order to provide as rapidly as possible the basic map information essential to natural-resource surveys, scientific research, national defense, and economic development."[1] Such "basic map information" needs to be widely known and it is a function of this symposium to provide that knowledge.

Alaska's map heritage reflects the variety of interests in the area during the past two centuries. Russians mapped the Aleutian Islands and adjacent coasts during their search for furs.[2] The British and the Spaniards in their attempts at dominion supplied data in Southeast Alaska and elsewhere. The Navy and the Coast and Geodetic Survey mapped to make fishing and shipping safe. A special commission plotted details of the Alaska-Canada boundary for political purposes.[3] The Army and the Geological Survey plotted the details of routes to, and the geology in, significant mining districts. And other government agencies and private organizations sponsored mapping for administrative and developmental purposes.

Yet, in 1940 the need for maps in Alaska became painfully apparent, as indeed it did for many other parts of the world. The Territorial coverage at that time was incomplete and too general. For analyses of various Alaskan relations with the rest of the world, the largest-scale dependable maps were the 1:1,000,000 scale World Aeronautical Charts. For research on distributions within the Territory, partial coverage at a 1:500,000 scale became available in 1923; this was the Alaska Road Commission's set of blueprints which covered all but Southeast Alaska, the Arctic Slopes, and the Aleutian Islands.[4] Larger scale maps

[1] National Research Council, *Proceedings of the Alaskan Science Conference*, Bulletin No. 122, Washington, D. C., April 1951, p. 193.

[2] TEBIENKOV, CAPT. M. D., Atlas of the North West Shores of America, St. Petersburg, 1852 (In Russian).

[3] Alaska Boundary Commission, (Map of) *International Boundary Between United States and Canada*, Nos. 1 through 13, 1:250,000, Washington, D. C., 1923–1928.

Alaska Boundary Tribunal, *Atlas of Award, British Atlas and U. S. Atlas*, U. S. Senate Document No. 162, 58th Congress, 2nd Session, Washington, D. C., 1904.

[4] The 13-sheet set is available by purchase through the offices of the Alaskan Road Commission, Juneau, Alaska.

were available, of course, from agencies like the General Land Office (township plats), the Geological Survey (topographic maps), and the Sanborn Map Company (urban block maps for insurance purposes).[5]

It is clear why so relatively little map coverage of Alaska was available in 1940. Alaska is a "Great Land" vertically as well as horizontally (fig. 1) and in variety of climate, vegetational cover, settlement, and accessibility. Quite simply the Territory had been a low priority part of the world and Alaska mapping had been proved to be difficult and expensive.

Military requirements after 1940 did for Alaska mapping what had not been done previously. Large- and small-scale charting were stimulated.[6] Strategic and tactical operations had to be founded on fact, and not fancy, of location.

Once begun, the mapping programs were continued in the post-war period. This continuity was based on military requirements in large part. However, nonmilitary development was taking place also. Settlement in general and agriculture and industry in particular were increasing. Between 1940 and 1950 the total Territorial population increased 77 percent; between 1950 and 1952 the estimated growth was 25 percent.

[5] Sanborn Map Company, (Insurance Map of) *Anchorage, Cordova, Douglas, Fairbanks, Haines, Juneau* (and *Thane*), *Ketchikan, Nenana, Petersburg, Seward, Sitka, Skagway, Valdez, Wrangell,* scale of 1:600, New York City, published between 1910 and 1937 and most revised to recent dates.

Board of Fire Underwriters of the Pacific, (Insurance Map of) *Bettles, Chena, Circle City, Eagle, Manley's Hot Springs, Nulato, Rampart, St. Michael, Tanana, Treadwell,* scale of 1:600, (available through Sanborn Map Co., New York City), published between 1907 and 1914 and not revised.

[6] Fueschel, C. F., Status of Topographic Mapping in Alaska, Surveying and Mapping, Vol. IV, 1944, pp. 13–16.

Figure 1.—Alaska—Surface configuration (physiographic diagram).

The introduction of new wood and metallic industries in Southeast Alaska and the improvement of transportation facilities elsewhere in Alaska assures still more development. Thus, it is clear that our needs for mapping have become, and will remain, great for ordinary living in the Territory. Consider also the increased necessity for maps, occasioned by the greater demand for research which parallels such growth.

Alaska's map heritage also reflects the improvements in surveying and mapping techniques in recent decades. Whereas the early mappers worked on foot with dog teams, the present day mapping is likely to be done with "weasels" and helicopters. Early surveyors' controls were by laborious astronomic fixes, but recent triangulation and hydrography have been controlled by electronic position indicators and by the use of Shoran. Many of the experiments and developments of new surveying techniques, such as airborne instrumental surveys, have been made in Alaska.

Of great significance to recent Alaska mapping are aerial photographs. One of the earlier air surveys in the world was made in the early 1920's for an inventory of Southeast Alaska's forests. Since then practically all of Alaska has been covered with aerial photographs (fig. 2), with large areas being covered with single-lens verticals and several areas being photographed more than once with either single- or multilens photographs.

Aerial photographs have been triple-use tools in Alaska mapping: (1) They have been used for planimetric and hypsometric mapping of parts of the Territory by photogrammetric methods.[7] (2) They have been employed as bases on which to plot the results of field research or for orientation. (3) They have been used as source materials, that is, as the medium from which data on surface or subsurface conditions are determined by the techniques of air photo interpretation.[8] Further work on each of these uses is certain to produce means of improving the efficiency of mapping in Alaska.

In spite of the improvement of surveying methods, mapping in Alaska is still approached with great respect for existing and potential problems. Current literature includes references to these problems which have a sobering effect on listings of the Territorial mapping needs.[9]

Yet, from the knowledge of present Alaska mapping programs research analysts and the nonprofessional public may draw encouragement and much physical aid. Therefore, there are presented hereafter the details of the present and planned programs of seven of the more active mapping agencies in Alaska. In general, the first programs presented involve small-scale mapping and the later programs the larger-scale mapping.

[7] Davidson, J. I., The Geological Survey Radial Intersector, *Photogrammetric Engineering*, Vol. VIII, 1942, pp. 229–239.

Pryor, W. T., Aerial Surveying on the Alaska Highway, 1942, *Public Roads*, Vol. 24, 1947, pp. 275–290.

[8] Cady, W. M., Aerial Photos as an Adjunct to Arctic and Subarctic Geologic Reconnaissance, *Trans. of New York Academy of Sciences*, Vol. 7, sec. 2, April 1945, pp. 135–138.

Reed, J. C., The Use of Airplane Photos in the Geologic Study of the Chichagof Mining District, Alaska, *Photogrammetric Engineering*, Vol. VI, 1940, pp. 35–44.

Stone, K. H., Aerial Photographic Interpretation of Natural Vegetation in the Anchorage Area, Alaska, *Geographical Review*, Vol. XXXVIII, 1948, pp. 465–474.

[9] Colbert, L. O., Programming Field Operations in Alaska, *Journal of the Coast and Geodetic Survey*, No. 2, April 1949, pp. 3–7.

Earle, R. A., Surveying Difficulties in the Arctic, *Journal of the Coast and Geodetic Survey*, No. 2, April 1949, pp. 81–82.

Eichelberg, E. W., The Bering Sea Survey, *U. S. Coast and Geodetic Survey Field Engineers Bulletin No. 13*, Washington, D. C., Dec. 1939, pp. 73–78.

Hoskinson, A. J, Control Surveys in Alaska, Surveying and Mapping, Vol. XII, 1952, p. 142.

Jeffers, K. B., Arctic Mapping Surveys, *Journal of the Coast and Geodetic Survey*, No. 4, December 1951, pp. 23–31.

Washburn, B., Mapping Mt. McKinley, *Scientific American*, Vol. 180, January 1949, pp. 47–51.

FIGURE 2.—Alaska aerial photograph coverage.

The Aeronautical Chart and Information Center

By CAPTAIN CHARLES E. CHAMBERS
U. S. AIR FORCE, ELMENDORF AIR FORCE BASE, ALASKA

THE comparatively recent development of Alaska's industry and economy has placed the Territory immediately in the air age. The Territory includes many areas that lack the facilities of roads, railroads, or waterways, and whose only easy means of communication is by air. In a total of 586,400 square miles, there are only 2,500 miles of passable roads and only 642 miles of railroads to service its scattered and isolated population. Thus, Alaska is largely dependent on commercial airlines and the bush pilot to cover the great distances between separated communities.

This dependence on air travel brings out the need for aeronautical charts of Alaska to a degree possibly exceeding the requirements of other regions. Aware of this, government agencies recently have made plans for the complete mapping and charting of the Territory as soon as possible. To this end, the U. S. Geological Survey, the Coast and Geodetic Survey, the Army, the Navy, and the Air Force have participated in extensive mapping programs, which include geodetic control, aerial photography, and topographic, hydrographic, and reconnaissance surveys. These surveys have been followed by the publication of various series of maps and charts; and from the standpoint of small-scale map and chart coverage, Alaska today is possibly in a better position than many other parts of the world.

The Aeronautical Chart and Information Center of the U. S. Air Force has been the prime mover in programming and financing aeronautical charts of Alaska on relatively large scales, such as 1:250,000. The charts of this series are actually being compiled from basic compilations of the U. S. Geological Survey by not only the Aeronautical Chart and Information Center, but also by the Coast and Geodetic Survey and commercial contractors.

The production of maps and charts by the U. S. civil agencies is considered a normal contribution to the Department of Defense. The Department of the Air Force endorses and supports the map and chart production programs of these agencies when their programs conform to the primary requirements for military air operations. The production efforts of the Air Force are directed toward foreign areas. The Aeronautical Chart and Information Center must provide and maintain current graphic materials for world-wide operation of aircraft on administrative and training flights, as well as strategic and tactical air operations.

In Alaska as well as in other domestic areas, the Air Force is depending almost entirely on the civil agencies for map and chart production. The Aeronautical Chart and Information Center produces Radio Facility Charts, Pilot's Handbooks containing Approach and Landing Charts for fields used by military aircraft, and miscellaneous air information publications to supplement the map and chart production of the civil agencies.

The U. S. Air Force, along with the Royal Air Force, covers the world with several series of Radio Facility Charts for military use. Inasmuch as these charts contain current information on frequencies, hours of operation, etc., of radio facilities used for navigation and communication purposes, it is vital that they be made available to the user with the least possible delay. This requirement prompted the ACIC to establish local compilation and drafting facilities at Anchorage for the preparation of these charts. They are revised once each month and then sent to Seattle for reproduction. In less than 2 weeks from the lock-up date the printed charts are back in Alaska, and distribution throughout Alaska has been completed. Our aim is to cut this time to 1 week. For correction of the Radio Facility Charts between issues, the Aeronauti-

cal Chart and Information Office located in Anchorage issues a military Aviation Notice approximately every 2 weeks.

Both the quantity and quality of the aeronautical charts of Alaska have undergone considerable improvement within recent years.[10] In the past, the World Aeronautical Chart (WAC) series at scale 1:1,000,000 was the only complete air coverage available, except at very small scales. But today, the Pilotage Chart series at scale 1:500,000 also completely covers Alaska. These two series are compiled from the same source material, and are prepared for the Air Force by the Coast and Geodetic Survey on a reimbursable basis.

Several government agencies are currently engaged in surveying and mapping and charting in Alaska with the end in view of providing excellent medium-scale coverage sufficient to satisfy all military and civilian requirements that can be anticipated at this time. We are concerned here only with those chart series which will be used for flying.

The government agencies now have coordinated arrangements by which one agency, and only one, performs the basic compiling of the topography in any one area. Compilation proofs are furnished other interested agencies who adjust format, border, sheet lines, and basic details to adapt the product to their special needs. In this way, the one compilation, insofar as topography is concerned, may be the basis for a ground map, a nautical chart, or an aeronautical chart, or all of these. In the case of the military agencies, this exchange of compilation proofs has been formalized under the Joint Specification Agreements. The same plan, however, with slight modifications, is also employed by civilian agencies.

As to aeronautical charts, the most outstanding Alaska series currently in production is the Approach Chart series at a scale of 1:250,000, being published by the ACIC. This series, started in the fall of 1951, is planned to cover the entire Territory of Alaska eventually. By June 1953 charts will have been completed covering the Aleutians, the Alaska Peninsula, and adjacent islands to the eastward. It is expected that all the coasts of Alaska will be covered with charts of this series by January 1954. The project is being accomplished by ACIC on a contract basis, primarily with the civil agencies.

In compiling the Approach Chart series, compilation proofs of the USGS Alaska Reconnaissance Topographic series, scale 1:250,000, have been used. These reconnaissance maps were compiled at the Denver Office of the U. S. Geological Survey from trimetrogon and other aerial photographs, and all other available source material. They will be described more fully in a following paper in this symposium.

A conspicuous feature of the new Approach Charts is the presentation of relief in shaded tints, with color differentiation between elevations. A chart will have a three-dimensional appearance that resembles a stereoscopic view, or a view of the terrain as actually seen from the air. The Approach Charts of Alaska will contain hydrographic information which has not heretofore been shown on USAF aeronautical charts. All coastal charts of this series will show depth curves, offshore rocks, and bottom characteristics in the same way they are shown on the nautical charts of the C&GS and the Navy. The additional data make possible utilization of these charts in an emergency by military elements other than the Air Force. Moreover, this extra information does not clutter the chart, as it appears only in the water areas which would otherwise be blank.

It is hoped that this 1:250,000 scale Approach Chart series of Alaska, when completed, will satisfy all medium-scale charting requirements of military aviation.

Since the end of World War II, the ACIC has maintained Instrument Approach and

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[10] USAF, ACIC, *USAF Catalog of Aeronautical Charts*, Ninth Edition, Washington, D. C., December 1951.

USAF, ACIC, *USAF Catalog of Aeronautical Information Publications*, Second Edition, Washington, D. C., June 1952.

Landing Charts for those airfields in Alaska for which Instrument Approach and Letdown procedures have been authorized. These charts, assembled in a loose-leaf binder titled "Pilot's Handbooks—West Canada and Alaska" are used to supplement the Radio Facility Charts and the Air Navigation Charts in normal day-to-day flight operations. These charts contain a minimum of topographic detail which is critically selected with a view to showing only the features that might assist the pilot in locating the airfield. Perhaps the most interesting feature of these charts, in a cartographic sense, is the diagram of the field at a scale of 2 inches to the mile, which shows the location of approach lights, beacon lights, and other facilities that a pilot may need to use in making a landing.

It is realized that aeronautical chart requirements may change in the future, and it is expected that more cultural detail will have to be added as Alaska develops. It is Air Force policy to anticipate the chart requirements of the future and to initiate new series as they are required.

The U. S. Coast and Geodetic Survey

By COMDR. M. E. WENNERMARK
U. S. COAST AND GEODETIC SURVEY

MAPPING has been a major function of the U. S. Coast and Geodetic Survey since its organization almost 150 years ago. During this period the work of this Bureau has expanded progressively in scope and importance with the increased demand for its products. At the present time the Coast and Geodetic Survey is charged with the collection of data necessary for certain mapping and charting operations of both the interior and the coastal areas of the United States and its possessions, including Alaska; also with the compilation and printing of charts for these areas.

More specifically, these activities are included: The execution of geodetic control surveys; the topographic mapping of the coastal areas; the survey and charting of the coastal waters, including bays, harbors, and inland tidal waterways; the compilation and printing of the aeronautical charts of these areas that are required for civil aviation and for military use where requirements are parallel. The ocean tides and the field of geophysics also fall within the realm of research of this Bureau.

Each of these activities has a part in the current Alaska mapping program. I should, therefore, like to discuss them briefly, and in so doing, outline in a general way the past accomplishments, the present program, and the future plans.

Geodetic control surveys are necessary for the rigid control of position and the orientation of maps and charts. Triangulation provides the latitude and longitude of each station established and the azimuths between adjacent stations.

Basic triangulation has now been completed along the entire coastal area of Alaska, including the Aleutian Islands, the Bering Sea, and the Arctic Ocean (fig. 3). Triangulation has been provided along the Alaska Highway from Whitehorse, Yukon Territory, to Fairbanks, where connections were made to arcs of triangulation along the Alaska Railroad from Anchorage, and along the Richardson Highway from Valdez. Other triangulation surveys have been made along the Glenn Highway from Anchorage to Gulkana, along the new highway from Paxson to Cantwell, along the Steese Highway from Fairbanks to Circle, and along the Yukon and Kuskokwim Rivers. Connections with the triangulation scheme have been made to St. Lawrence, St. Matthew, St. George, and St. Paul Islands.

The positions of the stations are determined on the North American 1927 Datum which is the base for triangulation in Can-

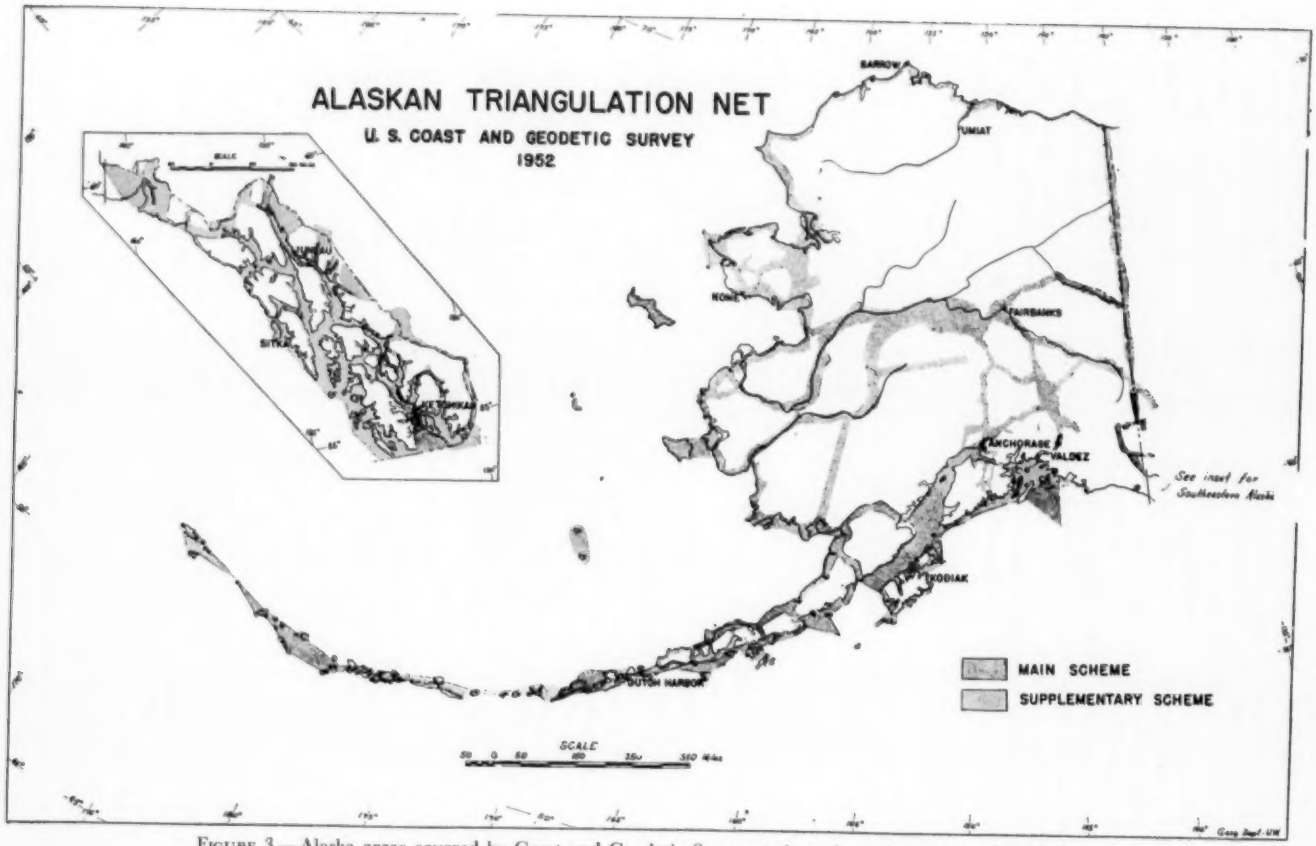

FIGURE 3.—Alaska areas covered by Coast and Geodetic Survey main and supplementary triangulation.

ada, the United States, and Mexico. The stations established in Alaska are, therefore, shown in their correct relative positions to those established in each of the countries mentioned.

During the summer of 1952 the Coast and Geodetic Survey has had five triangulation parties operating in Alaska. One party operated along the south shore of Norton Sound, one along the Holitna River from Sleetmute southward, one from McGrath to Ruby and from McGrath toward Cantwell, one along the Steese Highway, and one along the north shore of the Alaska Peninsula in the vicinity of Cold Bay.

Each party includes about 22 men. Transportation is by means of airplane, helicopter, weasel, boat, and truck. Field work is usually started about the middle of May and continued through the summer months to the latter part of September. Along the Arctic Coast and north of Brooks Range, this work has been carried on during the winter months when transportation between observation points is by means of cat train and motorized sled.

Angles are measured with precise theodolites that can be read to tenths of seconds. Base lines from 5 to 8 miles in length are measured with invar tapes at intervals of about 150 miles along the arcs. Astronomic stations for the determination of latitude, longitude, and azimuth are inserted at intervals of about 150 to 200 miles along the arcs. The astronomic observations are made by a specially equipped party.

The future program contemplates triangulation along the Stony River in western Alaska; an arc from Fairbanks to Bettles, thence to Umiat, and thence northward along the Colville River to a connection with established triangulation along the Arctic Ocean. It is also planned to work along the Yukon River upstream from Tanana, and on the Porcupine River to Rampart House on the Alaska-Yukon boundary.

Precise leveling has been virtually completed along the Alaska Railroad and along the main Alaska highways. Bench marks for which elevations above mean sea level are determined have been established at intervals of approximately 1 mile. In and near towns, airports, and construction areas, greater bench mark coverage has been provided.

An active program of photogrammetric surveys has been underway in Alaska for the past 15 years, and has proceeded at an accelerated pace since World War II. The Coast and Geodetic Survey is responsible for making topographic surveys of the Aleutian Islands and some of the larger islands in the Bering Sea. In other parts of Alaska topographic surveys are being made of the coastal areas as needed for the nautical charts.

Where the terrain has low-relief characteristics, planimetric maps are made; where the area is more rugged, topographic maps are made. The contour interval of the topographic maps is 100 feet in the more rugged areas and 25 or 50 feet in the areas with more moderate relief.

Photogrammetric field personnel are usually attached to the triangulation parties and work right with them. This is also often true in the interior of Alaska, in which case the data are furnished to other agencies for their use in map compilation. Along the south side of the Alaska Peninsula and in the Aleutian Islands the field work is done by personnel working from the hydrographic ships because of the nature of the terrain.

Considerable mapping has been completed in southwestern Alaska but there are still gaps along the coast where the photography is not adequate or additional field work must be done. Elsewhere in the coastal areas much remains to be done.

Aerial photography is obtained each year as weather permits. Most of the photographs are taken with the nine-lens camera which is ideal for areas where the control is widely spaced because its great span permits large scale photographs to be taken in these areas and rigidly controlled with the little control available. Most of the nine-lens photography in Alaska is taken at a scale of 1:20,000 on the vertical picture. This scale permits easy identification of alongshore features, and is, therefore, espe-

cially desirable where control for the hydrographic survey is to be established.

When, for various reasons, it is not practicable or expedient to take nine-lens photographs, single-lens photographs are taken at a scale of 1:40,000. These have a large ground coverage and give the necessary accuracy with about the same amount of control as required for nine-lens photographs. The photographs are enlarged to a scale of 1:20,000 for field and office use. The details of the enlarged single-lens prints, however, is inferior to that of the nine-lens photographs.

The airplane has made vast inroads into Alaska in the last decade, a trend that should continue for some time to come. It is equally true, however, that much of Alaska's commercial traffic will continue to move by salt water. The coastal waters furnish a 6,000-mile roadway for the Alaska fishing, mining, logging, and freighting industries. These waters, as well as the offshore seaways, are traversed by vessels of the Merchant Marine, as well as by those of the United States Navy. Accurate charts are essential to the safe navigation of these and all vessels. This is especially important in Alaska waters with their countless hidden dangers to navigation.

Surveys of Alaska waters have been carried on by Coast and Geodetic Survey vessels for many years, and have covered about 200,000 square miles of these waters (fig. 4). However, much remains to be done as this is indeed a vast area, some 740,000 square miles in extent.

At the present time, four major survey vessels, each with a complement of from 80 to 120 officers and men, are engaged in surveys in the Aleutian Islands, the Bering Sea, and along the south coast of the Alaskan Peninsula, and it is planned to continue these for some years in the future. Adequate charts are needed in these waters for national defense, as well as for future commercial developments.

Two smaller craft, each with a complement of about 16 officers and men, are engaged in charting operations in Southeast Alaska. In 1952 surveys were being made in Taku Inlet, Peril Strait, and in bays on the west coast of Prince of Wales Island. Surveys will continue in Southeast Alaska and will be resumed in Prince William Sound and in other parts of the Gulf of Alaska in the near future.

The measurement and study of the tide is a year-round activity. Some 10 or 12 standard tide stations are kept in continuous operation in Alaska, and numerous short-period stations are established each season in the vicinity of the hydrographic surveys. Tidal observations are needed for the determination of the mean lower low water datum which is used for the reduction of the soundings. Mean high water and mean sea level are also derived from tidal observations. The former is used in topographic mapping, the latter as the initial elevation in precise leveling.

The field of geophysics was covered in considerable detail at the Second Alaska Science Conference under the title of Geomagnetism and Seismology. Therefore, I shall treat this subject in just a general way.

Magnetic field surveys are made periodically in Alaska to provide data for the inclusion of isogonic lines and magnetic compass roses on nautical and aeronautical charts. Magnetic information also serves those interested in the magnetic techniques of exploration for minerals and petroleum.

Magnetic observatories are operated at Sitka, Fairbanks, and Point Barrow as a necessary auxiliary to the field surveys; also, for the collection of data on magnetic fluctuations necessary in the study of radio-wave propagation and for the prediction of radio fade-outs.

Although not a vital part of the mapping program, seismographs are also operated at the observatories at Sitka and Fairbanks for the detection and location of earthquakes, including local Alaska shocks. This activity contributes specifically to the functioning of the Seismic Sea Wave Warning System spanning the Pacific Ocean, which is operated for the protection of Hawaii from loss of life from seismic sea waves.

It is, of course, impossible to cover adequately all phases of the Coast and Geo-

FIGURE 4.—Alaska areas covered by Coast and Geodetic Survey hydrographic and topographic surveys.

detic Survey Alaska mapping program in the short time allotted. Also, it is important to note that the plans for the near future, as presented, are subject to such alteration as world conditions or public demand may dictate.

The Corps of Engineers*

By ALBERT L. NOWICKI
CHIEF ENGINEER, CORPS OF ENGINEERS

IT IS a distinct pleasure to participate in this conference and to present a résumé of the Corps of Engineers' efforts in the military mapping of Alaska. Before proceeding with such discussion, however, a brief statement is in order concerning the mapping and photographic responsibilities and the primary interests of the Corps of Engineers.

The Assistant Chief of Staff, G-2, U. S. Army, is responsible for the determination of military mapping requirements and priorities for map coverage pertinent to planning and operations. The Air Force is responsible for the procurement of aerial photography required by the Army for military mapping and for aerial photography required by the Air Force for charting purposes; the Navy also provides aerial photography for the military mapping requirements of the Army when the Air Force is unable to provide the coverage.

The Office, Chief of Engineers, through the Army Map Service, is responsible for the prosecution of field surveys; the production and distribution of military maps, relief maps, geodetic control, and engineer intelligence data; the preparation of specifications and priorities for aerial photography required for mapping; and the technical control of the 30th Engineer Base Topographic Battalion.

At the end of World War II the map situation in Alaska, from the standpoint of military adequacy, could be summarized as follows: map coverage available for military use was, in many cases, of irregular and widely separated areas; sheet sizes varied from 1-foot square to 3-foot square formats; field surveys in many cases were local and isolated in nature, tied to unadjusted astronomic positions and dependent on barometric readings; topographic maps did not generally meet standard accuracies nor were they adjusted to a common datum; and over-all coverage, with the exception of small-scale aeronautical charts, did not exist.

In 1947, the General Staff of the Department of the Army, confronted with new military requirements and recognizing the deficiencies in the military mapping of Alaska, through the Assistant Chief of Staff, G-2, Army, prepared a consolidated map plan to meet military needs and took steps to implement it. In the preparation of this plan consideration was given to many factors, the more important of which are as follows: scale and contour interval desired; need for an over-all map sheet layout with maximum size of published sheets to fit the military 22- by 29-inch field press; priority of requirement for individual sheets and blocks of sheets; availability of aircraft and photographic facilities; availability of geodetic and map survey facilities; availability of photogrammetric compilation facilities; relative priorities with respect to other worldwide military mapping needs; and finally, of course, the amount of funds that could be reasonably expected to be applied to the project. The start of hostilities in Korea and the consequent effect on world conditions further empha-

* Publication approved by Office of Public Information, Department of Defense.

sized the need for adequate map coverage and for acceleration of the coordinated program.

Generally, the over-all military mapping plan envisioned 1:50,000 scale topographic map coverage of the lines of communication of the "heartland," the main inland water arteries in the southern half of Alaska, and certain western coastal areas and along the Alaska Peninsula. Likewise, it envisioned 1:25,000 scale topographic map coverage of the Aleutian Chain, and certain other selected areas of strategic importance in the military defense of the Territory. Further, availability of over-all coverage of Alaska, the Aleutians, and the other islands in the form of provisional 1:250,000 scale maps was considered to be of paramount importance—this provisional series to be followed as soon as possible by revised editions meeting standard map accuracies. Small-scale communications-and-planning maps, photomaps of certain selected strategic areas, certain city plans, and over-all coverage by plastic relief maps complete the basic requirements as stipulated in the consolidated map plan. Supplementing the map requirements are certain other requirements, namely, coverage of most of the Territory with vertical aerial photography flown to mapping specifications, adjustment of all horizontal geodetic control points on the 1927 North American Datum and subsequent conversion to Universal Transverse Mercator Grid coordinates, placing of the Universal Transverse Mercator Grid lines on all military maps of 1:250,000 and larger scales, and the coverage of relatively inaccessible parts of the Territory by Shoran-controlled vertical aerial photography.

Soon after the basic map plan was formulated it became apparent that its implementation as originally envisioned was very questionable unless newly developed short-cut techniques could be incorporated, certain specifications relaxed, additional manpower made available in the field, and aerial photographic facilities drastically increased.

Five of the more important steps subsequently taken to improve the situation are as follows:

First.—The 30th Engineer Base Topographic Battalion was recalled from the Hawaiian Islands and placed under the operational control of the Army Map Service. Although this battalion is stationed at Fort Winfield Scott in the United States, it is deployed to certain areas in Alaska during the summer months, along with AMS field parties, for the purpose of establishing the supplemental and picture-point control necessary for the compilation of large-scale maps. Further, with its large source of survey manpower, this battalion carries out classification survey operations, identifies cultural and control items on aerial photographs, and evaluates new mapping photography being flown by the Air Force and Navy to insure its suitability for photogrammetric purposes.

Second.—Specifications for the establishment of supplemental mapping control were relaxed considerably for certain areas of Alaska by resorting to the use of stereoplanigraphs for aerial triangulation purposes, instead of the multiplex equipment. Through the use of these instruments, the spacing of horizontal and vertical ground control points can be greatly increased. The net result is that fewer control points are necessary, the cost of operations is reduced, and considerable time and manpower are saved in the field.

Third.—Helicopters and light airplanes were used for detailed reconnaissance, classification of detail, triangulation, and recovery of existing control points. Helicopters are now being used to reach inaccessible peaks, and in combination with the aneroid altimeter to determine elevations for vertical control points. Needless to say, such extensive utilization of helicopters and light planes, together with the employment of altimeter techniques has facilitated immeasurably the field operations in the more rugged and undeveloped areas of Alaska.

Fourth.—Full use of the aerial photography facilities of the Navy has been made to supplement those of the Air Force. In this way full advantage can be taken of the relatively short, 100-day photographic season. Relaxation of the minimum solar altitude requirement in certain cases was made so as to allow as much flying time per day as possible. Likewise, flying heights in the more remote areas were increased to 20,000 feet, or higher, in order to reduce the number of photographs and flight

lines and, consequently, the amount of ground control.

Fifth.—Finally, to insure maximum effort and to avoid the possibility of duplication, the extent of current participation of all concerned with Alaska mapping has been clearly defined. Thus, the Coast and Geodetic Survey is carrying out certain supplemental mapping control activities in conjunction with their high-order surveys, as well as completing the topographic mapping of the Aleutian Chain; the Geological Survey is carrying out field survey operations, compiling, drafting, and publishing large-scale civilian map editions in the "heartland" and "panhandle" areas, and compiling and publishing provisional civilian coverage at 1:250,000 scale of all of Alaska and the Aleutians; the 30th Engineer Battalion is carrying out field survey operations outside the "heartland" areas, in the Alaska Peninsula and on Kodiak Island; the Army Map Service is converting all civilian editions to military scales, either 1:25,000, 1:50,000, 1:100,000 or 1:250,000, placing the Universal Transverse Military Grid on them, as well as compiling and publishing certain military topographic maps from the control established by the 30th Engineers and the photography flown by the Navy and Air Force. All unclassified military compilations are being made available to the appropriate agency for issue of the corresponding civilian editions. Classified military maps are being made available for civilian publication after the pertinent classified information has been removed.

So much for the salient features of the coordinated program. Let us now see what has been accomplished to date and what is contemplated for the near future.

Of the 94 sheets in the Aleutian Islands and the 47 sheets of St. Lawrence Island being prepared by the Coast and Geodetic Survey at scale 1:25,000, 8 have been converted by AMS (Army Map Service) to military editions and 42 are in the process of being converted. Likewise, the 17 sheets of Kodiak Island compiled by the Geological Survey are being converted to scale 1:25,000 by AMS.

Of the 153 provisional sheets at 1:250,000 scale covering Alaska and the Aleutians, 111 have been published to date by the USGS (U. S. Geological Survey), 17 are in reproduction, and the remaining 25 sheets should be available before the end of 1952. The Army Map Service has already converted 92 to the military edition, 17 are soon to be published, and the remaining 44 sheets will be published by the spring of 1953. The USGS will publish special separate editions of the majority of the sheets depicting shaded relief; and the AMS will convert these also to the military edition.

The USGS has published 119 sheets, scale 1:63,360, and is compiling 334 additional sheets at this scale. Of these 453 sheets, AMS has converted 115 to the military edition at 1:50,000. The majority of these are located along the lines of communication in the "heartland" area or in the panhandle area of Alaska.

The Army Map Service is compiling 112 sheets at 1:50,000 scale in western Alaska. In addition, 58 photomaps at scale 1:25,000 of certain selected strategic areas have been compiled and published. Also 19 plastic relief maps at 1:1,000,000 scale have been published covering all of Alaska and the Aleutians; 10 plastic relief sheets at 1:250,000 in the "heartland" area are in progress at present. A total of 85 sheets in the "heartland" area at 1:25,000 scale have been published by AMS, with 60 additional in progress. These have been copied from USGS 1:63,360 scale sheets, augmented by additional contours, and enlarged in scale.

A combination shaded-relief, communications, and military-planning map, 35 by 42 inches in size and at 1:1,000,000 scale, has recently been compiled by AMS from late-date information and is now ready for distribution.

In 1952, the 30th Engineer Topographic Battalion carried out field survey operations in western Alaska, the Alaska Peninsula, and Kodiak Island. An area of approximately 45,000 square miles was covered—an area equivalent to about 200 map sheets at 1:50,000 scale. The compilation of a number of these sheets should begin as soon as the field control data have been computed and adjusted.

The enthusiasm, aggressiveness, and ingenuity with which the 30th Engineer Bat-

talion has carried out its assignment in Alaska during the last two summers have been most gratifying. This battalion's sustained efforts have far exceeded expectations and should have a marked effect on the rate at which mapping of the less developed and more remote regions of the Territory can be expected.

Although emphasis in this paper has been given to the current mapping efforts of the Army, too much credit cannot be given to others who have cooperated and contributed to the same cause. Agencies such as the Geological Survey, Coast and Geodetic Survey, Alaska Road Commission, Weather Bureau, Forest Service, Bureau of Land Management, Civil Aeronautics Administration, Bureau of Reclamation, Fish and Wildlife Service, Soil Conservation Service, Aeronautical Chart and Information Center, Navy Hydrographic Office, Air Force and Navy Air Squadrons, and the Alaska Command—just to mention a few—all can be proud of their past and present contributions.

Even though much has been accomplished to date, a great deal still remains to be done. Continued collaborative efforts by those agencies represented here at this conference will go a long way to hasten the time when this Territory will be adequately surveyed and mapped. Needless to say, the Corps of Engineers expects to continue its mapping efforts in Alaska and to be alert to any new techniques applicable to the efficient accomplishment of such mapping.

The Topographic Division of the U. S. Geological Survey *

By EARLE J. FENNELL

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WE HAVE good reason to be proud of the early history of exploratory surveying and mapping of the Territory of Alaska. Many government organizations took part, including the War and Navy Departments, the Coast and Geodetic Survey, and the Geological Survey. The men who took part in those early expeditions operated under pioneer conditions and were cursed with a paucity of material and funds. They were blessed, however, with high professional skill, deep interest, and an abiding faith in the future of Alaska. Their performance was consistently over and above that required in the routine discharge of their duties. The results of their labors are a significant contribution to the advancement of the scientific investigations and research pertaining to the resources of Alaska.

The Geological Survey became officially interested in Alaska at a very early date, and began actual reconnaissance surveys in 1889. The principal objective at that time and for many years thereafter, was the investigation of the mineral resources of Alaska. Although this was the principal objective, many subsidiary results evolved that were not at first considered a part of the major problem. Through the years, as Alaska has developed, the requirements for geologic, topographic, and hydrologic data have increased. Whereas the Geological Survey's early mapping served the mining industry principally, and served it well, present topographic mapping is required: (1) to complete the inventory of resources of the Territory; (2) to aid in the exploration and development of minerals; (3) for use in locating land and air routes of transportation; (4) as an aid to the "bush" pilots who have contributed so much to the development of Alaska; (5) to further forestry in Southeast Alaska; (6) to study and develop the vast hydroelectric potential; (7) to further geologic and water resources

* Publication authorized by the Director, U. S. Geological Survey.

investigations; and (8) to serve the very important needs of military defense.

During the early days, our mapping operations were carried on by combined geologic and topographic parties. These parties explored and mapped large isolated areas at scales of 1:500,000 and 1:250,000, mostly the latter, in order to determine the mineral potential. They also mapped small areas of known mineral value at larger scales, principally 1:62,500 but with some small areas at 1:24,000. This course of action resulted in a pattern of mapping in disconnected areas at various scales and with various contour intervals. The area covered by this mapping amounted to about half of the total area of the Territory. This mapping was adequate for immediate needs of the mineral industry, but did not present the uniform coverage and consistency of scale so important to general civilian and military usage.

Therefore, prior to World War II, members of the Alaskan Branch of the Geological Survey conceived the idea of a standard series of 1:250,000 scale maps of Alaska, which could be broken down into mile-to-the-inch or large-scale series. The first layout of such a series was made with the primary thought of holding the number of sheets to a minimum, and of having them a uniform size. When this layout was coordinated with the military about 1947, it was found necessary to change the sheet layout in order to fit the size of standard military field presses. This problem, as well as many others pertaining to the topographic mapping of the Territory, has been worked out through the constant cooperative efforts of civilian and military mapping agencies, in order to avoid unnecessary duplication of work.

The design of a major sheet layout is one problem, but the actual preparation of the maps is a greater and more intriguing one. Prior to final confirmation of the 1:250,000 scale sheet layout, the Geological Survey began the accumulation of source data for the compilation of a provisional series of 1:250,000 scale maps. The source material for these maps consisted of earlier planetable surveys, trimetrogon compilations for aeronautical charts of World War II and other mapping by the Geological Survey for the military forces, mapping by the 29th Engineers, mapping by the Coast and Geodetic Survey for use in nautical charts, and any other mapping available.

Early in 1953, the publication of the first complete series of maps of Alaska at a uniform scale will be completed by the Geological Survey. This provisional series of 153 quadrangles at a scale of 1:250,000 has held a high military priority since 1948, and is expected to serve as the basis of planning for more accurate compilations at the same scale and for future larger scales such as inch-to-the-mile compilations (*see* fig. 5).

As previously stated, these maps were compiled from existing source material, and presented a challenging problem to those responsible for the coordinating of data from aerial photography, control surveys, terrestrial photography, sketches, and miscellaneous maps at a variety of scales. A contour interval of 200 feet was planned, but several quadrangles of this provisional series have been published either with a contour interval of 1,000 feet or as planimetric maps, because of the scarcity of source material. Relief shading accentuates the surface configuration and many of the quadrangles have been published in separate editions of this type. Plans are now being made for the compilation of a revised, standard series of 1:250,000 scale quadrangles, utilizing new ground control, additional photographic material, and the mile-to-the-inch maps that have been completed since the provisional series was started.

This 1:250,000 scale series serves a wide variety of needs, but does not provide the detailed information required for many purposes and in many areas. Therefore, during and immediately following World War II, attention was given to developing a program of mile-to-the-inch topographic mapping that would provide for military and civilian needs. Owing to the problems of military defense, particular attention was,

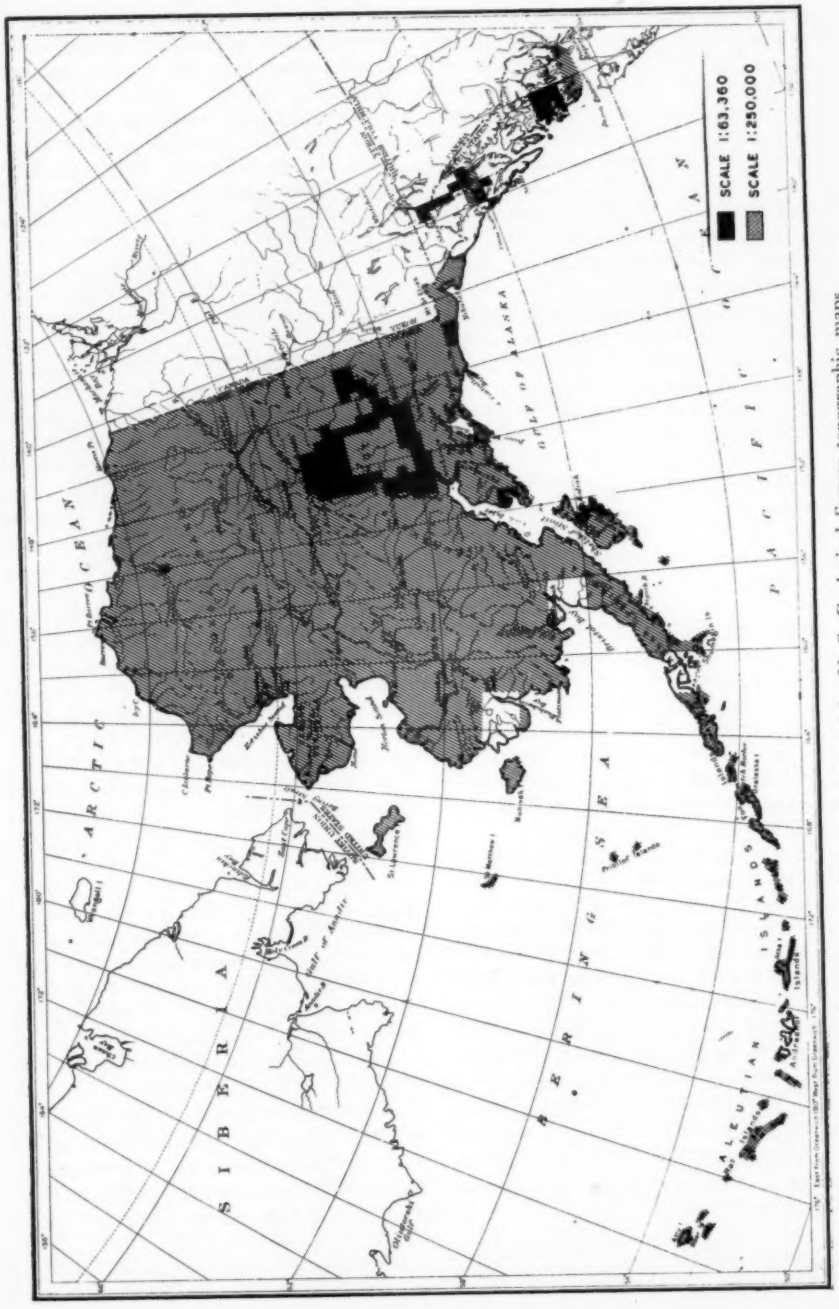

FIGURE 5.—Alaska areas covered by U. S. Geological Survey topographic maps.

and is, being paid to following the priorities for mapping as determined by the military. These priorities centered on the "heartland." As a result, the major effort of the Geological Survey in Alaska mapping has been, and is, concentrated along the transportation routes in central Alaska —Anchorage to Fairbanks and east to the Yukon Territory. At the same time, enough mapping is being done in Southeast Alaska to satisfy the minimum needs for civilian industrial developments.

The aerial photography for this mapping, described in an earlier paper in the symposium, has been and is being obtained by the Air Force and the Navy.

The ground surveys for this mile-to-the-inch mapping have been accomplished through the combined and coordinated efforts of the Geological Survey, Coast and Geodetic Survey, and the Corps of Engineers. During the field seasons of 1948 through 1951 the Geological Survey sent an average of 17 field parties to various points in central Alaska, Kodiak Island, and Southeast Alaska. In these seasons, averaging about 4 months each, the parties completed ground control and advance photo interpretation in areas totaling about 100,000 square miles. Maps covering a large part of this area have been subsequently compiled by stereophotogrammetric methods in our office in Denver, Colo., and much of it has now been published.

Our parties used helicopters extensively for field transportation. The 1951 operations are a good example of the amount of work that can be done by well-trained field parties using helicopters. In that season 26 engineers flew 82,500 miles in 1,330 hours and surveyed more than 37,000 square miles. This work involved 3,200 landings and takeoffs in order to occupy 562 triangulation stations and establish 1,600 elevations. The Geological Survey estimates that to do the same amount of work by conventional methods would require nearly four times as many personnel at a considerable increase in cost.

Alaska has been the proving ground for several of our advances in mapping techniques, other than the more spectacular helicopter successes. Many developments in terrestrial and aerial photogrammetry were the direct result of Alaskan experiments which began in 1905. Recently, electronic methods of obtaining horizontal and vertical control, specifically, Shoran and the radar altimeter, have been under trial there.

Another mapping program was undertaken on the Arctic Coast by the Geological Survey in 1946 in connection with Naval oil investigations. This program consisted of the preparation of a series of unpublished reconnaissance planimetric maps at 1:48,000 scale. These were compiled by using radial-line extension on trimetrogon photography with a minimum of ground control. The large scale was to accommodate more detail that was obtained from supplemental vertical photography.

The Geological Survey believes that the present requirement for topographic maps in Alaska demands the following general program: (1) Completion of an up-to-date series of 1:250,000 scale maps; and (2) completion of the mile-to-the-inch maps in the most vital areas of the Territory, estimated to be about half the total area. This mile-to-the-inch program will not exclude comprehensive coverage of northern Alaska, but will provide for mapping "spot" areas as the need may arise.

It is our aim to carry out such a future program. For the next several years we plan to develop our annual programs along the lines outlined by military necessity and, as those requirements are met, we will devote more capacity to meeting civilian needs in Southeast Alaska and in various parts of interior Alaska. In keeping with our traditional interest in Alaska matters, and with a well-trained and well-equipped staff, we will continue to exert every effort to satisfy the mapping requirements of the agencies and individuals concerned with the development of the resources of Alaska.

FIGURE 6.—Alaska areas covered by Geological Survey geologic maps published, all scales.

The Geologic Division of the U. S. Geological Survey*

By GEORGE O. GATES
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MOST of the geologic mapping in Alaska has been focused on the evaluation of mineral resources; i.e., it has been aimed toward determining where minerals may be found and toward determining the order of magnitude of the reserves of known deposits. Geologic mapping with these objectives is now centered mainly in the Alaskan Geology Branch of the U. S. Geological Survey, and it is this type of mapping with which this paper is concerned.

Past and current geologic mapping falls roughly into three classes: reconnaissance mapping at scales of 2 to 8 miles to the inch, semidetailed to detailed systematic mapping at a scale of about a mile to the inch, and large-scale mapping, less than 500 feet to the inch, of relatively small local mineralized areas. The large-scale maps, needed in determining the nature and extent of individual deposits, cover a very small area compared with all Alaska, and they are not considered in the following discussion. This third class is an important one, however, and one to which a large share of our effort has been devoted since 1940.

The reconnaissance mapping yields initial exploratory information on the kinds, distribution, and relations of rocks present. Such mapping indicates the potential for mineral resources of an area and roughly delineates more restricted areas that warrant systematic mapping at a larger scale to evaluate more fully the mineral resources and potential for mineral resources.

Though much has been done in the period of more than 50 years that the Geological Survey has been engaged in geologic mapping in Alaska, the task that remains is still very large. More than 40 percent of the Territory is still unmapped geologically. The amount accomplished, however, is particularly remarkable if we consider that before 1940 only a few geologists were assigned to this work in an area of nearly 600,000 square miles.

Areas in Alaska that have been mapped geologically and for which geologic maps have been published are shown in figure 6. Most of the maps are reconnaissance in type, with scales varying from 1 to 16 miles to the inch. Most of the coverage, however, is at a scale of approximately 4 miles to the inch. The tendency is for these maps to be centered near mining districts, and for their boundaries to follow drainage divides.

Though small-scale reconnaissance mapping of a geologically unknown area reveals information about the potential for minerals, another type of mapping—semidetailed to detailed and systematic—is needed for the more favorable areas to evaluate more fully the actual and potential mineral resources. For example, reconnaissance mapping may show that a large area is underlain with a thick sequence of sedimentary rocks of marine origin. The area is then known to be one that holds possibility of the presence of oil. However, systematic mapping at a larger scale of 1 mile to the inch or larger is needed to obtain a knowledge of the structure and stratigraphy adequate for determining the potential for oil.

As can be seen in figure 7, only a small part of Alaska has been geologically mapped at scales of about a mile to the inch. The coverage shown is that for which maps have been published and totals less than 5 percent of the Territory. The task that remains for this class of mapping is even greater than for reconnaissance mapping. I do not mean to imply, however, that all of Alaska should be mapped at a scale of 1 mile to the inch; the advantage to be gained would not be worth the cost. But geologic maps at this scale of large areas in Alaska

* Publication authorized by the Director, U. S. Geological Survey.

FIGURE 7.—Alaska areas covered by Geological Survey geologic maps published, mainly mile-to-the-inch scale.

are needed—areas known or believed to be favorable for the occurrence of minerals and mineral fuels. Mapping at this scale of rapidly developing parts of Alaska is also needed to determine sources of construction materials and to furnish geologic information useful in selecting more favorable sites for construction, such as routes for highways.

Except for a few omissions, which I will mention later, I have briefly sketched the status of published geologic maps of Alaska. Next I will consider geologic mapping completed within the last few years and mapping now in progress by the Alaskan Geology Branch (fig. 8). For the past 10 years funds, personnel, and priorities for other work have permitted only one field party annually on reconnaissance mapping; this has been in the lower Kuskokwim region. The northeastern part of the region between the Holitna and Aniak Rivers, an area of about 8,000 square miles, has been mapped and a professional paper embodying the results is being prepared. Of the southwestern part, which has an area of 18,000 square miles and which is bounded roughly by the Kuskokwim and Aniak Rivers and by Bristol and Kuskokwim Bays, about 16,000 square miles has been mapped.

For the past several years much of the effort has been on systematic mapping at a scale of about a mile to the inch or larger in areas selected for their mineral potential. This mapping can be classified on a commodity basis, with the emphasis on fuels. In connection with coal investigation three areas in the Alaska Railroad region have been mapped at a scale of 1 mile to the inch or larger; the southern half of the Kenai lowland, the northern part of the Matanuska Valley north and west of Palmer, and a belt along the north side of the Alaska Range extending for 130 miles from the Savage River on the west to Jarvis Creek on the east. The specific objective is to determine the reserves of coal, i.e., to delineate the individual beds, measure their thickness, determine their attitudes and relations to enclosing rocks, and calculate the tonnage. Pending final publication, much of the result of this work on coal has been made available in preliminary open-file reports.

Semidetailed to detailed mapping has been carried out and is in progress in connection with petroleum investigations in parts of southern coastal Alaska and in northern Alaska. In southern Alaska the work is in two areas—the Gulf of Alaska area where Tertiary rocks are exposed, extending 300 miles from the mouth of the Copper River to Icy Point, and the Alaska Peninsula-Cook Inlet area of exposed Jurassic rocks, which extends from Herendeen Bay northeastward to the Nelchina area. Mapping of the Gulf of Alaska area is well advanced. It is nearly completed in the Katalla and Yakataga areas and the whole province will probably be completed in two more field seasons. Much of the mapping has been at a scale of 1 mile to the inch. Preliminary reports with maps have been released to the public. In the Alaska Peninsula-Cook Inlet area systematic mapping is completed for the Chinitna Bay area on the Alaska Peninsula and is now in progress in the Nelchina area. Investigations in this province have been handicapped by lack of aerial photographs and mile-to-the-inch base maps.

Petroleum investigations in northern Alaska have been in progress since 1945 as part of the United States Navy's program of exploration for oil in Naval Petroleum Reserve No. 4. Most of the funds for the work have been furnished by the Navy Department. The investigations that have been carried out all lie within an area of about 70,000 square miles. Much of the mapping has been at a scale of approximately a mile to the inch. Some of the mapping is at a larger scale to give very detailed geologic information for sites selected as more favorable for drilling.

During the past 10 years, metals investigations have involved much less systematic mapping than fuels investigations. The emphasis in metals investigations has been on examination of local mineralized areas and individual deposits. The geologic maps compiled during such examinations are at

FIGURE 8.—Alaska areas covered by Geological Survey geologic maps not yet published.

various large scales, generally more than 500 feet to the inch. Some systematic mapping at a scale of 1 mile to the inch or larger, however, has been done. This type of mapping has been in connection with the following metals investigations: (1) Juneau gold belt; (2) northwestern part of Chichagof Island; (3) Haines-Klukwan area in the northern part of Southeast Alaska; (4) Latouche Island in Prince William Sound; and (5) Willow Creek gold mining district. About 17 mile-to-the-inch quadrangles have been mapped at these large scales.

Two other important types of work on metals have involved little geologic mapping—work in connection with Defense Minerals Exploration Administration activities and Trace Elements investigations. The Trace Elements study is essentially a search for radioactive minerals in areas considered to be favorable from geologic information already known.

Construction materials investigations during the past few years have centered mainly on individual deposits and local areas and therefore have involved large-scale mapping and little at a scale of 1 mile to the inch. To meet the need for information on construction materials the first step has been to determine the nature and extent of known deposits. The next step will be systematic mapping along transportation routes.

In addition to the geologic mapping that has been described and that is now centered in the Alaskan Geology Branch, geologic mapping has been carried out for the past few years in connection with Alaskan investigations by three other organizational units of the U. S. Geological Survey. To assist in evaluating the ground-water resources, the Ground Water Branch has systematically mapped, at a scale of 1 mile to the inch, about 200 square miles in the Matanuska River and north of Knik Arm. Geologic mapping has been in progress for the last several years in the Aleutian Islands by the General Geology Branch and in other parts of Alaska by the Alaska Permafrost and Terrain Section of the Military Geology Branch in connection with terrain and related military engineering studies. The mapping in the Aleutians is mainly at a scale of 1:25,000. Mapping by the Alaska Permafrost and Terrain Section is mostly at a scale of 4 miles to the inch; some is at 1 mile to the inch.

The need for geologic mapping in Alaska is obvious, both reconnaissance mapping in hitherto unmapped areas and more detailed systematic mapping. How much more reconnaissance mapping should be done? I think the answer to this question is simple and most would agree that all the unmapped parts of Alaska should be mapped at least through the reconnaissance phase. What parts of Alaska should be systematically mapped at a scale of 1 mile to the inch or larger? Though large parts should be mapped at a scale of 1 mile to the inch, the answer to this question is not as clear and any answer will change with changing national needs and with trends in development of the Territory. Factors to be considered in selecting areas for such mapping are: mineral possibilities revealed by reconnaissance mapping and other information, need for geologic information basic to selection of sites for construction, and the need for detailed understanding of the geology in certain areas that is basic to the understanding of the geologic picture of Alaska.

The geologic mapping in Alaska should be speeded up. Now that suitable aerial photographs are becoming available for large areas in Alaska, more application of photogeologic techniques is one means of doing this. In this way much geologic information can be obtained that is useful in planning so that the maximum amount of actual field work can be completed in the short field season. Also, for some areas certain kinds of geologic information can be obtained from aerial photographs more accurately and rapidly than from field observations. For remote areas the rate of geologic mapping can be increased by more adequate logistic support.

The U. S. Forest Service

By HAROLD E. ANDERSEN

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MAPS are indispensable working tools of a forester, being used in every phase of forest administration and management. Prior to the last 2 years the available maps of Southeast Alaska were generally inadequate. The material available was: small-scale reconnaissance-type topographic maps of a few areas produced by the U. S. Geological Survey; a few maps of the International Boundary Survey in the rugged mountainous mainland along the Canada-Alaska boundary, and tri-lens aerial photographs taken in 1928 by the Navy. Using these sources, and Coast and Geodetic Survey control and charts, the Forest Service had compiled for its use 2-inch-to-the-mile planimetric maps of a large part of the Tongass National Forest. These maps were the best available, but were subject to inaccuracies. Also, lack of topographic detail limited their usefulness in the generally rough terrain. With increasing development of the timber industry and the advent of a pulp mill, better maps were needed.

Aerial photography is now an essential part of topographic mapping, and aerial photographs are the foundation of the mapping program for Southeast Alaska. This entire area, approximately 45,000 square miles, was photographed by the Navy in 1948 (fig. 2). A large part of the area lies within the boundaries of the Tongass National Forest.

The coverage comprises two sets of aerial photographs taken at the same time from a flight elevation of 20,000 feet. For mapping purposes the U. S. Geological Survey required relatively small-scale (1:40,000) vertical photographs, obtained with 6-inch-focal-length cameras. However, the Forest Service needed photographs at a scale at least as large as 1:20,000. These last were taken with two K-17 12-inch-focal-length cameras tilted right and left at an angle of 18° from the vertical. Lateral coverage approximately equal to that of the 1:40,000 scale vertical photographs was obtained. The two cameras were set in a split mount in tandem and could be adjusted for crab. The proper forward interval was obtained by exposing the two K-17 cameras to obtain the desired overlap. A third 6-inch-focal-length camera was synchronized to operate at every second exposure of the twin cameras.

To date the U. S. Geological Survey has published about 12 inch-to-the-mile quadrangles in Southeast Alaska. Field control has been completed in approximately 140 quadrangles in this area, leaving only about 25 quadrangles still requiring completion of field control. Map compilation and publication will follow as rapidly as funds and other priorities permit. These maps are excellent and are invaluable to anyone concerned with land use or resource management.

Construction of a $46,000,000 pulp mill at Ketchikan has begun. For planning this, maps of the Ketchikan Pulp Allotment were urgently needed. Arrangements were made to obtain film positives at a scale of 2 inches to the mile of the multiplex manuscripts of quadrangles in this pulp allotment. This scale is most suitable for timber-type maps and much preliminary work. These maps have been in use this field season and it is believed that film positives of the multiplex manuscripts are superior for our use to prints of the final compilation. The principal points of the vertical photographs as well as other control data not shown on the published maps appear on the multiplex manuscripts. This control is of great value in orientation when timber-type boundaries are being projected from the 1:20,000 photographs to the base map. Field checks made by personnel of the Alaska Forest Research Center have

shown that boundaries thus obtained are well within the accuracy required.

Timber-type maps show boundaries between stands of different tree species, age classes, and often site or productivity classes. This type map is used to determine the areas of various timber types and age classes in preparing volume estimates. The timber-type map forms the basis of planning logging operations, regulating cutting, and preparing management plans. The cost of preparing such maps is greatly reduced by having accurate topographic base maps and aerial photographs. It is possible to recognize a number of forest types and age classes, as well as non-productive areas, on the photographs.

The nominal scale of one of the split verticals varies from 1:19,000 along the inner edge to 1:23,000 at the far edge of the photograph; the scale along the isoline is 1:20,000. An oblique contains perspective, that is, distant objects are pictured at a relatively smaller scale.[11] However, because these photographs were taken at a relatively high altitude and at a small angle from the vertical, the perspective effect is not pronounced. At the first casual inspection they appear to be verticals. Stereoscopic effect can be obtained by proper orientation under a stereoscope of any two successive pictures on the same side of the flight line. The right and left photographs of any pair overlap slightly along the nadir parallel, which is directly under the plane. The nadir edge must be oriented toward the observer in viewing a stereoscopic pair. When oriented in this manner the observer is looking in the same direction the camera was pointed.

Timber-type boundaries are delineated on the photographs with a china marking pencil after stereoscopic study. Type lines are transferred to the base map by use of a Fairchild Rectoplanigraph. This instrument is a reflecting projector or camera lucida which can be used for both vertical and oblique photographs.[12]

The type maps are checked in the field by running with compass and steel tape lines selected at random. At the same time volume data are obtained by means of sample plots along the check lines. The use of aerial photographs, the base maps, and random sampling reduce field work to a minimum and obtain better results at less cost than would be possible if the photographs and base maps were not available.

The Alaska Forest Research Center is completing a study on procedures and accuracies with which timber-type maps can be prepared using the 1:20,000 scale oblique photographs and the base maps which are now becoming available. Results to date indicate that satisfactory type maps can be made from the obliques provided a good base map is available.[13] Use of these obliques, referred to as split verticals, for type mapping, is probably the first employment of photographs of this type. Canadian foresters have made considerable use of obliques, but these were usually high obliques or trimetrogon photography.[14] The Canadian Forest Service has experimented with modified trimetrogon photography, substituting low obliques for the high obliques.[15]

[11] KATZ, A. H., 1950, Contributions to the Theory and Mechanics of Photo-Interpretation from Vertical and Oblique Photographs, *Photogrammetric Engineering*, Vol. 16, pp. 339–386.

LANE, B. B., 1950, Scales of Oblique Photographs, *Photogrammetric Engineering*, Vol. 16, pp. 409–414.

[12] BUCKMASTER, J. L., 1946, The Camera Lucida for Aero Mapping, *Photogrammetric Engineering*, Vol. 12, pp. 235–245.

[13] ANDERSEN, H. E., 1951, Characteristics of 1948 1:20,000 Split Verticals and Use for Preparation of Timber Type Maps in Southeast Alaska. Unpublished manuscript.

[14] ANDREWS, G. S., 1934, Air Surveys and Forestry, *Forest Chronicle*, Vol. 10, pp. 91–107.

[15] SEELEY, H. E., 1948, The Forestry Tri-Camera Method of Air Photography, Can. Dom. For. Service, *Forest Air Survey Leaflet 3*, 12 pp.

The Soil Conservation Service

By THOMAS H. DAY

SOIL SCIENTIST, SOIL CONSERVATION SERVICE

PROBABLY no subject relating to Alaska is more controversial among people both inside and outside Alaska than the Territory's agricultural potential. There are those who still visualize Alaska as a land of ice and snow and, on the other hand, there are the *Garden-of-Eden* boys who believe that it is only one step removed from heaven and that the only thing that won't grow here is bananas—and who likes bananas anyway? As both these extremist viewpoints are detrimental to the Territory's agricultural growth, some facts are necessary if agriculture is to develop rapidly on a firm foundation.

Several estimates have been made of the amount of agricultural land in the Territory. One of the earliest was made by Dr. C. C. Georgeson, first Director of Alaska Experiment Stations, who estimated that about 65,000 square miles were suitable for cultivation. W. A. Rockie, who headed the Matanuska Valley Survey for the Soil Conservation Service, reduced this figure to 4,500 square miles,[16] and Kellogg and Nygard reduce this still further to less than 1,600 square miles of cultivable land.[17] This last estimate seems to be somewhat low in the light of recent field studies.

The earliest actual attempt to map Alaskan soils and their agricultural possibilities was by H. H. Bennett and T. D. Rice[18] in 1914 and 1916. At that time two reconnaissance soil surveys were made: one covering most of the Territory, the other limited to the Kenai Peninsula. These surveys estimated the tillable land in the Tanana-Yukon and Cook Inlet-Susitna regions at 9,000 square miles. After these two surveys, more than 20 years passed before any further extensive agricultural mapping was done. Then in the Matanuska Valley, during the two field seasons of 1939 and 1940, the Soil Conservation Service made the first detailed land classification survey in Alaska, covering 318,000 acres. Since then the Bureau of Land Management has made some similar surveys, such as those of the Kenai Peninsula and the Anchorage plain. Also, the Agricultural Research Administration has made some soil surveys of a small part of the Matanuska Valley.

In 1948 a new series of detailed land classification surveys was started by the Soil Conservation Service. The mapping has been continued each summer since then. The rate of progress (except for 1948 when the work was largely exploratory) has varied from about 70,000 to 338,000 acres per season, with a total through 1952 of more than 1,000,000 acres (Table 1). This excludes the 318,000 acres of the earlier Matanuska Valley survey. All these recent surveys (i.e., since 1948) have been made at the request of the Alaska Soil Conservation District[19] and have been made either in areas where Soil Conservation subdistricts have been organized or where the land has been withdrawn by the Bureau of Land Management for study prior to possible settlement (fig. 9).

To make the surveys of the greatest pos-

[16] ROCKIE, W. A., What of Alaska, *Soil Conservation*, Jan. 1946, Vol. XI, No. 7.

[17] KELLOGG, C. E. AND NYGARD, I. J., Exploratory Study of the Principal Soil Groups of Alaska, *Agriculture Monograph No. 7*, U. S. Department of Agriculture, March 1951.

[18] BENNETT, H. H., Report on a Reconnaissance of the Soils and Agriculture of the Kenai Peninsula Region of Alaska, *U. S. Bureau of Soils*, Sept. 18, 1916.

BENNETT, H. H. AND RICE, T. D., Soil Reconnaissance in Alaska with an Estimate of the Agricultural Possibilities, *U. S. Bureau of Soils*, Sept. 16, 1914.

[19] The Alaska Soil Conservation District is a territorial organization of farmers formed under territorial law. The Soil Conservation Subdistricts are the local sub-divisions, e.g., the Palmer S. C. Subdistrict.

sible use, invitations have been extended to and accepted by interested Federal and Territorial agencies for field inspection of the completed surveys. This inspection is followed by a conference discussion of survey findings as a basis for establishing land capability classes. In addition, preliminary drafts of survey reports are circulated for comment and criticism.

Survey work conducted by the Soil Conservation Service is interpreted in terms of the nationally recognized system of land capability classification. This system groups land into eight broad classes on the basis of agricultural limitations with Class I being level, fertile land with no limitations and Class VIII, land not suitable for cultivation, grazing, or forestry. Each of these classes may be subdivided into as many as four subclasses to indicate the type of limitation (erosion risk, wetness, soil features, or climate). Wherever more specific information is desired the subclass may be further subdivided into units. In determining the land capability all pertinent physical factors are considered, e.g., soil depth, fertility, texture, climate, slope, and water-holding capacity.

TABLE 1.—*Acres Surveyed Through 1952 Season*

Area	*Surveyed Acreage*
Tanana Valley	
Fairbanks S. C. Subdistrict	141,500
Chena Withdrawal Area	79,800
Salcha-Big Delta Subdistrict	61,700
Dunbar Withdrawal Area	6,800
TOTAL	289,800
Matanuska Valley	
Palmer S. C. Subdistrict	138,800
Wasilla S. C. Subdistrict	200,000
TOTAL	338,800
Anchorage Plain	
Anchorage S. C. Subdistrict	32,500
Chugiak S. C. Subdistrict	38,000
TOTAL	70,500
Kenai Peninsula	
Homer S. C. Subdistrict	100,300
Ninilchik S. C. Subdistrict	39,300
Kenai-Kasilof S. C. Subdistrict	183,800
TOTAL	323,400
Grand Total Through 1952, 1,022,500 Acres	

As one might expect with a system of interpretations of physical factors, the evaluation of these factors and their significances may change with increased knowledge about them. Since the survey is a record of physical factors and not the interpretation only, a re-evaluation is relatively simple. For example, with our present knowledge of Alaska's poorly drained lands, drainage and cultivation of some of these areas do not appear to be economically feasible and they are therefore now classified as Class VIIw land, that is, unfit for cultivation because of wetness. However, some fields are being cleared and drainage ditches are being installed. Although this was done on some land as long as 4 years ago, no crops have as yet been taken from any land classed as VIIw. If the time comes when the facts indicate that this land can be economically drained, the necessary data are available on the field maps for a complete reclassification.

In addition to the land factors that affect land capability, significant culture is also mapped, such as important trails, roads, and cabins, as well as any other mappable features that bear on land planning.

Prior to field work aerial photographs at scales of 1:15,000 to 1:20,000 are carefully studied stereoscopically. At this time most of the different types of land are mapped provisionally, along with estimates of slope, wetness, flooding conditions, and kind of soil. We have found that, after 2 to 4 weeks of concentrated local experience, we can, in some cases, almost complete the mapping before going into the field, and that the principal need for field work is for checking. This situation is extremely advantageous where the climate is exceptionally rainy, as in Alaska. Also, where the vegetation is dense, as in Alaska, visibility in the field is often limited to

FIGURE 9.—Alaska areas covered by Soil Conservation Service detailed land classification surveys.

short distances, and it is often almost impossible to determine where the land-capability boundaries are without previous stereoscopic work.

In the field the surveyor checks his office findings by drilling holes 2 to 3 feet deep, with a 1¼-inch worm auger, at intervals that vary depending on the land complexity. Holes deeper than this are unnecessary because low subsoil temperatures generally limit significant root penetration to this depth. The surveyor also checks with a hand level the slopes that were estimated with the stereoscope and makes any changes to ensure the accuracy of the final map. While the survey is in progress the survey crew works an average of 10 hours a day and 6 days a week. The 10-hour day includes 8 hours in the field plus 2 hours in the evenings for inking and stereoscopic study of photographs. In this way maps are kept up to date and completed as the work progresses. Also, stereoscopic study in the evening of the next day's area assures that the data will be fresh in the surveyor's mind when he goes into the field.

In general these surveys are made of factors of immediate, practical significance. Such things as soil color or origin are considered only insofar as they indicate soil fertility or other features of practical value. In the interest of over-all government efficiency, surveys within the Territory have aimed at including any additional data that might be needed by other agencies interested in agriculture. So far this has not required any additional work; the Soil Conservation Service surveys are now accepted and used by all organizations, both Territorial and Federal, interested in the development of farms in Alaska.

There are several reasons for making these surveys, and several uses to which they may be put.

The first reason is the same that justifies the surveys in the States—that is, to help a person get the most out of his land and yet preserve it for future generations. The survey may be used in preparing a guide to the types of crops each kind of land is most suitable for, the fertilizer and cultural practices to use, and the control measures necessary to preserve the land from washing or blowing away.

Another use is as a guide to future settlement. The information can be used to help the individual settler find a suitable piece of land. Also, the Bureau of Land Management is utilizing the information in a gradual reopening of surveyed areas that have been temporarily withdrawn from settlement. In this way an equitable distribution of cultivable land to a maximum number of homesteaders is assured. In addition, as settlement almost inevitably follows road construction, some thought is now being given during the planning stage of road building to the types of land to be penetrated. A slight relocation of a proposed right-of-way in many cases may eliminate or at least reduce future secondary road requirements. Also, the advantages of encouraging settlement of good rather than poor land by planned road development are obvious.

Then there is the use to which any credit agency can put the survey information. Both the Farmers Home Administration and the Alaska Rural Rehabilitation Corporation use land capabilities in making Alaska farm loans.

Further use may be made of land capabilities in the development of an equitable land-tax system. The capability of the land should certainly be one of the factors considered in deciding how much tax must be paid. Of course, several other factors must be weighed, such as whether the land is cleared or not and nearness to a road. So far, nothing definite has been done in the Territory along this line, but land capabilities have been used successfully for taxation in many parts of the States.

Tabulation of the surveys through the 1951 season[20] shows that 362,000 acres, or

[20] Tabulations have not as yet been made for 1952 field work. For more detailed breakdown of 1951 figures see paper entitled "Capability and Need for Alaska Agricultural Land," by S. W. Cosby, presented at Second Alaskan Science Conference, McKinley Park, Alaska, Sept. 1951.

41 percent of the area surveyed, are fit for occasional or continuous cultivation. Further, 381,000 acres, or 44 percent of the surveyed acreage, are suitable for grazing or woodland. However, these figures are based on data from surveys that are largely limited to areas that are relatively easily accessible and are already being developed to some extent. Considering Alaska's vastness, it is apparent that we do not have much more than a good start toward the final answer. But as time goes on and if these surveys are continued, we will gradually get a clearer picture of Alaska's true agricultural potential. This is probably not quite so good as many of its boosters say but much better than its detractors would have us believe.

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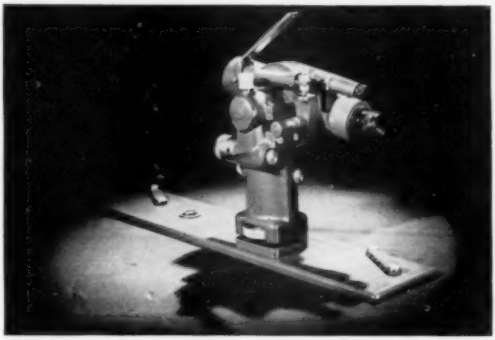

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Audio-Visual Aids in Teaching Surveying and Mapping

By PROFESSOR KENNETH S. CURTIS
PURDUE UNIVERSITY, LAFAYETTE, INDIANA

"BECAUSE it strikes the intellect and emotion simultaneously during a period of high concentration, a film can impress knowledge on the mind quicker and be retained longer than most other mediums of instruction."

During the past 10 years a number of films on surveying and mapping have been produced by industrial concerns and by various government agencies. The availability of these worthwhile teaching aids provides an opportunity to show the student something, whether it is motion, processes, techniques, sequences, or methods, which otherwise would be almost impossible. In compiling the list of audio-visual aids which follows, the intention was to select films that could be used to supplement teaching in the subject-field of surveying and mapping. It might be a course in elementary surveying, route surveying, topographic surveying, engineering astronomy, land surveying, geodetic surveying, hydrographic surveying, cartography, or photogrammetry.

Any film naturally has its limitations and cannot be an end in itself, showing every phase of a subject. There is always more that must be explained in a general class discussion. This should be anticipated and, therefore, the suggestion is made that each film be previewed before use, so that the instructor has a thorough knowledge of its content. Previewing is necessary also because some films may be too advanced and others too elementary for inclusion in a particular college course. The purpose and main points to be stressed should be reviewed and discussed with the class prior to showing.

Presented at the Third National Surveying Teachers' Conference held at the University of Illinois Summer Surveying Camp, Blackduck, Minn., August 3–8, 1952.

These aids should be used to supplement one's teaching and to make a clear and forceful presentation of the subject by creating interest, emphasizing important points, and effectively demonstrating techniques and methods. They are a highly efficient teaching tool, but one must learn when and how to use them. The fact that some teachers have grossly misused films should not deter others from investigating them thoroughly, and with an open mind, for possible benefits.

The producer or distributor of each film is noted at the end of the descriptive text. The complete addresses of the distributors are in a separate tabulation at the end of this article. In many cases the films can be borrowed from local film libraries or local film distributors. Many universities have film libraries from which they can be borrowed. The list designates, for each film, whether it is in black and white (B&W) or in color, the running time in minutes, whether silent or sound, the year released, and whether loaned-free or rental-charged. All motion pictures listed are 16 mm. and can usually be purchased from the producer.

AERIAL PHOTOGRAPHY

Aerial Photography; Part I, Introduction: Aerial Camera Types (*TF-1138*).—9 min., 1940, U. S. Air Force. Shows the K3B, K7C, and K12 aerial cameras and demonstrates how to prepare the aerial camera for a mission.

Naval Photography in Intelligence (*MN-5348c*).—B&W, 18 min., sound, 1948, free, U. S. Navy. Presents the story of naval photographic reconnaissance during World War II, plus the role of naval photography in the post-war era. Also demonstrates the use of photography for industrial surveys and long-range topographic mapping.

Photo Canada.—Color, 30 min., sound, 1948,

rent, National Film Board of Canada. Story of the aerial mapping of Canada's vast north. Photographic detachments of the Royal Canadian Air Force are producing the "mosaic" from which will be drawn an accurate new map of Canada.

AERONAUTICAL CHARTS

Highways in the Sky (*TF 1-4803*).—Color, 30 min., sound, 1952, free, U. S. Air Force. Depicts in a very good manner the story of preparing aeronautical charts, from their inception through ground control, photogrammetric processes, compilation, reproduction, and distribution.

CARTOGRAPHY

Cartographic Activities in the United States.—Color, 45 min., silent, 1943, free, Bureau of the Budget. Depicts short scenes of cartographic activities in the various government agencies, but does not go into details of any of the methods used.

Preparation of Topographic Maps for Reproduction.—Color, 30 min., sound, 1951, free, U. S. Geological Survey. Shows in detail the necessary cartographic preparation of topographic manuscripts for reproduction.

GEODETIC SURVEYING

Geodetic Surveying.—Color, 45 min., silent, 1945, free, U. S. Coast and Geodetic Survey. Depicts the methods used in developing geodetic control from original reconnaissance surveys to the final office computations, including the erection of the Bilby steel tower, angle measurement, etc.

HISTORY OF MAPS

Caught Mapping.—B&W, 10 min., sound, 1942, free, General Motors Corporation. This film traces the development from old historical maps up to the modern road map so accurate and up-to-date. Shows field men, automobile road scouts, State highway officials supplying, checking, and relaying information. Entirely free from advertising.

Maps and Pioneers.—B&W and color, 23 min., sound, 1950, rent, Virginia State Department of Education. Traces the development of Virginia's map from the late 1500's through the early 1800's when the type of outlines and the symbols used became much like those of our modern maps. The film features three maps made from the actual land survey upon which many other contemporary maps were based.

Maps We Live By.—B&W, 22 min., sound, 1948, rent, Films of the Nations, Inc. Tells of the new frontiers of map making and map use now being explored to advance the welfare and solidarity of the United Nations. Also describes the history of maps.

HYDROGRAPHIC SURVEYING

Charting the Seas.—B&W, 24 min., sound, 1948, rent, British Information Services. Shows two surveys being carried out by the Hydrographic Department of the British Admiralty—the first based on visible landmarks, and the second on a remote foreign coast where absence of landmarks makes the task more difficult.

The Coast and Geodetic Survey.—Color, 22 min., sound, 1953, free, U. S. Coast and Geodetic Survey. Gives a brief résumé of the primary functions and activities of the Coast and Geodetic Survey. Film obtainable from the Washington office and each district office.

Hydrographic Surveying Operations of the Navy (*MN-6755a* and *MN-6755b*).—Color, 40 min., sound, 1950, free, Hydrographic Office, U. S. Navy.

Part 1—Establishing Primary Control Points.—20 min. Describes methods of developing geodetic control, including magnetic observations, azimuth, astronomical positions, and photogrammetric methods of establishing shoreline.

Part 2—Secondary Control and Hydrographic Development.—20 min. Describes erection of signals, tide gages, echo sounding, radar control of vessels, wire-dragging operations, current studies, and final processing of field records.

Hydrography for Charting.—Color, 20 min., sound, 1951, free, Hydrographic Office, U. S. Navy.

Part 1—10 min. Position fixing. Describes methods of fixing vessels' positions by visual fix, radar, and Lorac.

Part 2—10 min. Sounding and dragging. Describes use and operation of echo-sounding equipment and the use and setting out of wire-drag equipment.

Occupying an Oceanographic Station.—Color, 30 min., sound, 1949, free, Hydrographic Office, U. S. Navy. Shows detailed instructions for obtaining sea-water samples and temperature by Nansen bottle lowering and techniques of titration for determination of oxygen content and salinity.

Use of the Bathythermograph.—Color, 23 min., sound, 1950, free, Hydrographic Office, U. S. Navy. Shows the procedures in preparing for lowering, recovery, and care of the sensitive apparatus recording ocean depth and temperature.

INSTRUMENTS

Manufacture and Use of Modern Surveying Instruments.—B&W, 90 min., sound, 1949, free, Henry Wild Instrument Co. Depicts the manufacture of modern European surveying equipment from the raw material to the finished product, and also shows the use of these modern surveying instruments in the field.

LAND SURVEYING

Fundamentals of Land Surveying.—B&W, 35 min., sound, 1946, rent, University of California at Berkeley. Illustrates methods of taping over comparatively level ground, and taping over sloping ground using the method of breaking chain. A hundred-foot steel tape is used. Techniques of using the plumb bob, chaining pins, line rods, and hand level, as well as the coordinated use of the plumb bob and tape are stressed.

Maps and Surveys for Reservoirs.—Color, 45 min., silent, date unknown, free, Tennessee Valley Authority. Contains the sequence of operations involved in the cadastral aspects of reservoir surveying and the basic steps of regional topographic mapping by the multiplex process.

LEVELING

Leveling for Topographic Mapping.—Color, 20 min., sound, 1951, free, U. S. Geological Survey. Shows in detail the use of the U. S. Geological Survey precise level and rod in the development of the third-order level nets needed for proper vertical control in topographic mapping. Prepared for training purposes.

LITHOGRAPHY

How to Make a Good Impression.—Color, 20 min., sound, 1951, free, Harris-Seybold Company. Story of modern offset lithography.

MAP READING

Basic Map Reading (U. S. Army training films). All five films are black and white, with sound, made in 1945.)

Part I—Conventional Signs (*TF 21-2071*)—20 min. Presents each sign by first showing the feature it represents, then superimposing the sign over the feature, and finally showing the sign on the map as it appears in relation to other signs on the map.

Part II—Elevation, Distance, and Grid (*TF 21-2072*)—27 min. Uses drawings and straight photography to explain map symbols for contour lines and to point out how to interpret the concave and convex lines and estimate elevation. Measuring distances and grids.

Part III—Direction, Orientation, and Location With Compass (*TF 21-2073*)—34 min. A soldier with a map and a compass, lost from his squadron, is given step-by-step instruction in how to use these implements in finding his way back to the bivouac.

Part IV—Direction, Orientation, and Location Without a Compass (*TF 21-2074*)—22 min. A lost soldier is left to find his own way back with only a map. Step-by-step instruction on how to compute distance and locate objects on the map.

Part V—Photos and Photomaps (*TF 21-2075*)—23 min. Detailed instructions on identifying terrain features on maps. The size, shape, tone, shadow, and relation to relative objects are the main features emphasized in identifying objects.

How to Read a Map.—B&W, 10 min., silent, 1942, rent, Library Films. Shows how to interpret geographic and military maps. Elementary.

Let's Look at Maps—B&W or color, 11 min., sound, 1950, rent, Virginia State Department of Education. Explains the basic methods of representation and symbols used on maps for natural and man-made features. Actual scenes of Virginia are shown and compared with their map representations. Very elementary.

Maps and Their Uses.—B&W or color, 10 min., sound, 1951, rent, Coronet. Provides an introduction to the study of special symbols in maps, presents a variety of special-purpose maps, and demonstrates the different uses of these maps and their symbols. Elementary.

Maps Are Fun.—B&W or color, 10 min., sound, date unknown, rent, Coronet. Introduces the fundamental concepts of map reading. The principles of scale, symbols, physical and political maps, various uses of color, and how to use a map index.

Sport of Orienteering.—Color, 22 min., sound, 1948, rent, Silva Inc. Intended to develop interest in learning how to use a map and a com-

pass and to promote the sport of orienteering, which includes different games in practicing the use of maps and compasses. Made in Sweden with English sound track.

MISCELLANEOUS

Airplane Changes Our World Map.—B&W, 11 min., sound, 1942, free, Encyclopaedia Britannica Films, Inc. Describes the evolution of world map concepts and how the airplane has drastically reduced travel distances. Sequences include projection distortions, early maps and globes, latitude and longitude, and various projections.

Artillery Orientation by Sun and Star (U. S. Army training films).

Part I—The Altitude Method (*TF 6-1678*). —B&W, 25 min., sound, 1951. Determination of true direction by the altitude method of solar observation. Measurement of angles to the sun, corrections for parallax, refraction, and the solution of the celestial triangle based on observer's latitude plus altitude and declination of sun.

Part II—The Hour Angle Method (*TF 6-1679*).—B&W, 10 min., sound, 1950. Determination of true direction by the hour-angle method of celestial navigation.

Flying Surveyors.—Color, 30 min., sound, 1951, free, British Columbia Forest Service. Deals with the use of helicopters in topographic surveying and shows these machines operating at high and low elevations and under a variety of difficult conditions.

Flying the Weather Map.—Color, 25 min., sound, 1944, free, U. S. Navy. Observers determine weather conditions at posts. Features of the map: Various fronts represented by colored lines; symbols indicate precipitation areas, thunderstorms, rain showers, air masses, and pressure areas.

Latitude and Longitude.—B&W or color, 10 min., sound, 1947, rent, United World Films. Interprets latitude and longitude as angular distances from given points. Indicates how a position can be determined by latitude and longitude, and uses a sectional globe to show the relationship between angles subtended at the axis and linear distance on the surface of the globe.

Maps and Their Meanings.—Color, 15 min., sound, 1950, rent, Academy Films. Shows the meaning of the various color zones on physical maps and illustrates the type of land found in each of these zones. Animated maps, diagrams, and color photography show the effects of altitudes, latitudes, and rainfall on the way man uses the land. Elementary.

Maps for the Army.—Color, 37 min., sound, 1953, National Film Board of Canada. Tells the story of the production of a military topographical map in non-technical language and gives a broad picture of the methods employed by the Army Survey Establishment of the Royal Canadian Engineers.

Photogeology—A New Look for Oil.—Color, 22 min., sound, 1951, free, Geophoto Services. A well narrated technical film which shows modern methods of photogeologic evaluation.

Snow Harvest.—Color, 25 min., sound, 1946, free, Soil Conservation Service. The making of snow surveys in the high western mountains, showing techniques of measuring snow to forecast water supplies for irrigation and other uses. Shows beautiful winter scenery.

What is a Map?—B&W, 11 min., sound, 1947, Young America Films, Inc. By use of animation and special photographic techniques, the concept of maps is introduced and explained, first in terms of a plan of a living room, then in terms of a map of a section of a city. Elementary.

MULTIPLEX USE

Multiplex Mapping (*TF 5-1549* and *TF 5-1546*).—Color, 66 min., sound, 1949, free, Army Map Service, Corps of Engineers.

Part I—26 min. An introduction to the general principles of multiplex mapping; serves to familiarize mapping personnel with the Army Map Service method of preparing topographic maps by stereophotogrammetric methods from aerial photographs.

Part II—40 min. Concerns the technical procedures of multiplex operational principles of multiplex mapping.

Topographic Mapping by Photogrammetric Methods.—Color, 90 min., sound, 1947, free, U. S. Geological Survey. Portrays modern technical procedures employed by the Geological Survey in making topographic quadrangle maps, featuring the use of the multiplex method. Originally produced for training purposes.

NAVIGATION

The following films on celestial navigation are available through the Civil Aeronautics Administration. They might be of considerable use in courses in engineering astronomy where definition of terms concerning the earth, celestial sphere, stars, time, etc., are important. They are all in black and white with sound.

Celestial Navigation (U. S. Navy training films).

The Earth (*MN-83A*).—17 min., 1942. Explains the arrangement and meaning of the poles, great circles, parallels, meridians, longitude, latitude, nautical mile, and departure.

Charts (*MN-83B*).—19 min., 1942. Pictures, maps, diagrams, and a sound commentary are used to explain Mercator charts, gnomonic projections, and Lambert conformal projections.

Nautical Astronomy (*MN-83C*).—24 min., 1942. Shows the placing of celestial coordinates in relation to the earth. Reveals the use of declination, zenith point, nadir line, and June and September solstices.

Astronomical Triangle (*MN-83D*) *Parts I* and *II*.—37 min., 1942. How the astronomical triangle is formed and its use in determining the positions of ships on the earth's surface.

Time (*MN-83E*), *Parts I, II, III*.—56 min., 1943. Divides the globe into time zones; divides time into apparent, sidereal, and mean time; illustrates the use of the chronometer.

Star Identification (*MN-83F*).—17 min., 1943. Discusses the apparent movements of stars across the sky; locates and identifies constellations and 23 basic navigation stars.

Aerial Map Reading (*MN-83M*).—22 min., 1944. How to read an aeronautieal chart and the use of landmarks and features in finding position are studied in this film.

Celestial Navigation (U. S. Air Force training films).

Introduction and Location of Celestial Points (*TF 1290*).—18 min., 1944. Deals with basic principles of the location of points on the celestial sphere.

Latitude by Polaris (*TF-1545*).—10 min., 1944. Relationship between latitude and elevated pole, position and diurnal path of Polaris, and reduction of altitude of elevated pole. Description of the methods of solutions of the altitude of Polaris by mathematical formula and the use of tables.

Position Finding on the Earth (*TF-1204*).—15 min., 1944. Explanation of longitude and latitude; determination of geographic position; discussion of the Greenwich hour angle, local hour angle, and sidereal hour angle; and a discussion of celestial triangles and the use of various tables.

Loran for Ocean Navigation.—B&W, 20 min., sound, 1947, free, U. S. Coast Guard. Describes various uses of loran in ocean navigation.

Radar for Navigation.—B&W, 10 min., sound, 1947, free, U. S. Coast Guard. Shows the use of radar by ships entering harbors.

PROJECTIONS

Global Concepts in Maps.—B&W or color, 10 min., sound, 1948, rent, Coronet. Treats the three main concepts—the globe, distortion, and projection. Cylindrical, conic, and perspective projections are shown.

Impossible Map.—B&W or color, 10 min., sound, 1948, rent, National Film Board of Canada. Illustrates by example the fact that a true picture of the world is possible only when constructed on a globe. Distortion of surfaces when they are flattened is shown by use of a grapefruit. Elementary.

Introduction to Map Projection.—B&W, 18 min., sound, 1948 rent, United World Films. Various types of map projections are demonstrated and the advantages and limitations of each projection are discussed and compared with a map drawn on the globe.

TRAVERSE

Transit Traverse for Topographic Mapping.—Color, 30 min., sound, 1950, free, U. S. Geological Survey. Shows in detail the organization of a typical field party and the use of the transit and tape in traversing needed for proper horizontal control in topographic mapping. Prepared for training purposes.

TRIMETROGON

Reconnaissance Mapping with Trimetrogon Photography.—Color, 2½ hrs., sound, 1944, free, U. S. Geological Survey and U. S. Air Force; Bureau of the Budget. Shows all phases of the work in great detail. Somewhat long; on four reels. To see it at one sitting requires almost 3 hours. The continuity is divided into 14 sequences, but could be shown one reel at a time for periods of about 45 minutes running time per reel.

ADDRESSES

ACADEMY FILMS, Box 3088, Hollywood, Calif.

U. S. AIR FORCE, Central Film Exchange, Air Materiel Command, Wright-Patterson Air Force Base, Dayton, O.

ARMY MAP SERVICE, Corps of Engineers, 6500 Brooks Lane, Washington 16, D. C., and training stations

BRITISH COLUMBIA FOREST SERVICE, Attn: Public Relations Division, Chief Forester, Victoria, British Columbia, Canada

BRITISH INFORMATION SERVICES, 30 Rockefeller Plaza, New York City 20, N. Y.

BUREAU OF THE BUDGET, Director of Cinematography, Room 352, Executive Office Bldg., Washington 25, D. C.

UNIVERSITY OF CALIFORNIA, University Extension Visual Dept., 2272 Union St., Berkeley, Calif.

NATIONAL FILM BOARD OF CANADA, 1270 Avenue of the Americas, New York City 20, N. Y.

U. S. COAST AND GEODETIC SURVEY, Dept. of Commerce, Washington 25, D. C.

U. S. COAST GUARD HEADQUARTERS, Chief, Public Information Div., Washington 25, D. C.

CORONET FILMS, Coronet Building, Chicago 1, Ill., and other branch offices

ENCYCLOPAEDIA BRITANNICA FILMS, INC., 1150 Wilmette Ave., Wilmette, Ill., and other branch offices

FILMS OF THE NATIONS, INC., 62 West 45th St., New York City 19, N. Y.

GENERAL MOTORS CORPORATION, Film Section, Dept. of Public Relations, 3044 West Grand Blvd., Detroit 2, Mich.

U. S. GEOLOGICAL SURVEY, Map Information Office, Washington 25, D. C., and regional offices

GEOPHOTO SERVICES, 305 Ernest and Cranmer Bldg., Denver 2, Colo.

HARRIS-SEYBOLD COMPANY, 4510 East 71st St., Cleveland 5, O.

HYDROGRAPHIC OFFICE, U. S. Navy Dept., Washington 25, D. C., and training stations

LIBRARY FILMS, INC., 25 West 45th St., New York City 19, N. Y.

SILVA INC., LaPorte, Ind.

SOIL CONSERVATION SERVICE, 3500 Cleburne Road, Fort Worth 1, Tex.

TENNESSEE VALLEY AUTHORITY, Attn: Mr. W. S. Massa, Maps and Surveys Branch, Chattanooga, Tenn.

UNITED WORLD FILMS, INC., Educational Film Dept., 542 S. Dearborn St., Chicago, Ill., and other branch offices

VIRGINIA STATE DEPT. OF EDUCATION, Film Production Service, Richmond 16, Va.

HENRY WILD SURVEYING INSTRUMENTS SUPPLY Co., 26 Court Street, Brooklyn 2, N. Y.

YOUNG AMERICA FILMS, INC., 18 East 41st St., New York 17, N. Y.

BIBLIOGRAPHY

Educational Film Guide, 1951, H. W. Wilson Company, New York City, N. Y.

Index of Army Motion Pictures and Film Strips, October 1951.

Educators Guide to Free Films, 1951, 11th Edition, Educators Progress Service, Randolph, Wis.

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Bausch & Lomb Announces Photogrammetric Award

A NEW annual award in the field of photogrammetry has been offered by the Bausch & Lomb Optical Co., Rochester, N. Y. The award was announced at a meeting of the American Society of Photogrammetry in Washington, D. C.

Competition for the Bausch & Lomb Photogrammetry Award is open to any regular student, undergraduate or graduate, in a recognized college or university in the United States. Purpose of the project is to stimulate interest in photogrammetry—the science and art of making precise measurements from photographs, most commonly used in mapping for engineering projects.

First prize is $100 and a three-year, paid-up membership in the society, and there are two second prizes of $50 each, plus one-year memberships.

The awards will be based on papers of not more than 4,000 words describing a new use of photogrammetry or of photogrammetric equipment, or describing an adaptation or improvement in the use of the science. The papers will be judged by a committee of at least three members of the society.

The interest of Bausch & Lomb in the field stems from the fact that it is engaged in the development and manufacture of optical equipment used in photogrammetry, including Multiplex projection equipment used in compiling maps from aerial photos, and aerial camera lenses for photographing all kinds of terrain in complete detail from high altitudes.

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Surveying and Mapping News

Members are requested to send in surveying and mapping news items for publication in SURVEYING AND MAPPING.—EDITOR.

CURRENT SURVEYING AND MAPPING LITERATURE

MAGAZINE ARTICLES

A CENTURY OF PROGRESS IN CIVIL ENGINEERING. J. K. Finch. *Civil Engineering,* Volume 22, No. 9, September 1952. (Centennial issue.) (Reviews the development of civil and construction engineering over the hundred-year span since the founding of the ASCE.)

PHOTOGRAMMETRY COMES INTO ITS OWN. George D. Whitmore and Morris M. Thompson. *Civil Engineering,* Volume 22, No. 9, September 1952. (Centennial issue.) (A review of the entire subject with some interesting historical sidelights which date the beginnings of the science back to 1852.)

TOPOGRAPHIC MAPPING IN KENTUCKY. Phil M. Miles. *Proceedings American Society of Civil Engineers,* Volume 78, Sept. 1952. (Detailed account of the topographic mapping program of Kentucky in cooperation with the U. S. Geological Survey.)

AERIAL PHOTOGRAPHS FACILITATE SURVEYS OF PAVEMENT CONDITION. Adrian R. Legault and Howard M. McMaster. *Civil Engineering,* Vol. 22, No. 10, October 1952. (Describes another application of aerial photography to highway engineering.)

OUR CHANGING COASTLINE. Rear Adm. Robert F. A. Studds, Director, Coast and Geodetic Survey. *Shore and Beach,* Volume 20, No. 2, October 1952. (The President of the ACSM discusses the scientific causes of beach erosion and shoreline changes at the May 1952 meeting of the American Shore and Beach Preservation Association.)

THE APPLICATION OF RAY-TRACING METHODS TO THE REDUCTION OF SHORAN TO MAP DISTANCES. Arthur S. G. Grant. *Transactions American Geophysical Union,* Volume 33, No. 5, Part I, October 1952. (Ray-tracing methods are used to obtain formulas for the arc length of the shoran radio ray and for the corresponding geodetic map distance expressed in various mathematical formulae.)

THE EVOLUTION OF THE ENGLISH NAUTICAL CHART. A. H. W. Robinson. *The Journal of the Institute of Navigation,* Volume 5, No. 4, October 1952. (Interesting historical discussion of the development of British nautical cartography from the publication of Wright's chart of the world on the Mercator projection in 1600.)

TRIANGULATION CLOSURE INVESTIGATION. J. E. Lilly and P. Brunavs. *Transactions American Geophysical Union,* Vol. 33, No. 5, Part 1, October 1952. (Mathematical discussion of latitude and longitude closure equations.)

COPTERS SPEED MAPPING PROJECT. News item. *Aviation Week,* Volume 57, No. 19, November 1952. (In the summer of 1952 two helicopters mapped 57,000 miles of Canadian territory west of Hudson Bay, at a cost of approximately $3.80 per square mile.)

HYPSOMETRIC (AREA–ALTITUDE) ANALYSIS OF EROSIONAL TOPOGRAPHY. Arthur N. Strahler, *Bulletin of the Geological Society of America,* Volume 63, No. 11, November 1952. (This analysis indicates future applications of the method to studies of hydrology, soil erosion, and sedimentation, as well as military science.)

PHOTOGRAMMETRY. *Princeton Engineer,* Volume 11, No. 2, November 1952. (Brief general discussion.)

RECENT DEVELOPMENTS IN HYDROGRAPHIC SURVEYING AND CHARTING. Rear Adm. R. F. A. Studds. *The International Hydrographic Review,* Volume 28, No. 2, November 1952. (Discusses electronic methods of control and improved representation of depths and dangers on finished charts.)

MAP IN CABIN SHOWS LOCATION OF PLANE. News Item—McGraw-Hill World World News. *Aviation Week,* Volume 57, No. 19, November 10, 1952. (Describes installation of device developed in England which, by use of a lighted screen map, shows air passengers where they are at any given moment while in flight.)

ARROYOS. Sheldon Judson. *Scientific American,* Volume 187, No. 6, December 1952. (A discussion by a geologist of the origins of this typical landform of the Southwest and the climatic cycles which brought it about.)

MODERN TOPOGRAPHIC MAPPING. Kostka Mudd. *Sierra Club Bulletin,* Volume 37, No. 10, December 1952. (Non-technical discussion of photogrammetric methods, especially procedures employed by U. S. Geological Survey.)

SPEECH BY REAR ADMIRAL A. M. PRIDE, USN. (This was given by the Chief of the Bureau of Aeronautics at an Institute of Navigation meeting in New York.) *The Ensign,* Vol. 40, No. 9, December 1952. (Discusses instruments, charts, and other aids to both sea and air navigation.)

A SIMPLE TECHNIQUE FOR MAKING TOPOGRAPHIC MAPS MORE READABLE. W. R. Heath, *The Mountaineer,* Volume 45, No. 13, December 15, 1952.

REVISE ILS CHARTS. News Item. *Aviation Week,* Volume 57, No. 24, December 15, 1952. (Announcement of improved series of charts for use with instrument landing systems.)

A NEW WORLD MAP: SOME SIGNIFICANT FEATURES. G. R. Crone. *New Commonwealth,* Volume 24, No. 13, December 22, 1952. (A description of a world map on a new projection devised by H. J. Andrews, representing land masses as vast islands ringed by an outer ocean and with an inner "Midland Ocean.")

MORE EMPHASIS ON PRACTICAL EXPERIENCE PROPOSED FOR TEACHERS BY EXAMINERS. News Item. *Engineering News-Record,* Vol. 149, No. 26, December 25, 1952. (Includes text of a resolution, prepared by a committee of prominent educators in the field of engineering, and presented at the annual meeting of the National Council of State Boards of Engineering Examiners.)

A NEW PROJECTION FOR CUBIC SYMBOLS ON ECONOMIC MAPS. J. Ross Mackay. *Economic Geography,* Vol. 29, No. 1, January 1953. (Discussion of projectional properties of a cube. "It is no more possible, and no more desirable, to 'draw a cube' without any reference to its projectional properties than it is to do the same with a sphere.")

FLOATING COMPASSES. W. E. May. *Nautical Magazine,* Volume 169, No. 1, January 1953. (Interesting historical notes on the early development of ships' compasses.)

SWISS OPTICAL LEVEL HAS NO FOOTSCREWS. New Products Section, *Engineering News-Record,* Vol. 150, No. 2, January 8, 1953. (Ball-and-socket head replaces footscrews on Kern GK-1 Level.)

INTER-AMERICAN COOPERATION ON HIGHWAY PROBLEMS. Extraordinary Pan American Highway Congress, Mexico City, October 26 to November 1, 1952. By Jack Garrett Scott and Melville E. Osborn. *The Department of State Bulletin,* Volume 28, No. 708, January 19, 1953. (Discusses resolutions adopted by the congress, functions of the interim committee, and construction priorities established.)

EVALUATION OF MODERN MAPS. Richard Edes Harrison. *Special Libraries,* Vol. 44, No. 2, February 1953. General discussion of the complex factors involved in the appraisal of maps for various purposes.)

MAP THE WORLD. C. Lester Walker. (Excerpt.) *Harper's Magazine,* Volume 206, No. 1233, February 1953. (General discussion with emphasis on inadequacy of the world mapping program.)

THE GEOGRAPHY OF DISEASE. Jacques M. May. *Scientific American,* Volume 188, No. 2, February 1953. (Mr. May, Director of the Department of Medical Geography at the American Geographic Society, discusses the increase in knowledge of the pattern of diseases in relation to planning their more effective control, and tells of the Society's program for constructing an atlas of maps showing world distribution of various diseases.)

TOPOGRAPHIC MAPS. California, Department of Natural Resources, Division of Mines, Olaf P. Jenkins, Chief. *Mineral Information Service,* Vol. 6, No. 2, February 1, 1953. (Entire issue devoted to a popular discussion of topographic maps with illustrations, index maps showing progress of topographic mapping in California, a bibliography and a list of recently-published quadrangle maps of California.)

CIVIL ENGINEER GRADS FAR SHORT OF DEMAND. (News Item). *Engineering News-Record,* Vol. 150, No. 9, February 26, 1953. (Gives results of a preliminary survey of enrollment and prospective graduates of both accredited and non-accredited engineering schools.)

BOOKS AND PAMPHLETS

ENGINEERS AND IVORY TOWERS. Hardy Cross. Edited and arranged by Robert C. Goodpasture. 141 pp. *McGraw-Hill Book Co.,* New York 36. $3.00. (The engineering philosophy of a well-known teacher.)

PRACTICAL PHOTOGRAMMETRY. H. Oakley Sharp. *MacMillan Co.,* New York. (c. 1951). 229 pp. (Reviewed in SURVEYING AND MAPPING, April–June 1952.)

THE ORIGIN OF THE EARTH. Prof. W. M. Smart. Pp. viii, 239, and 8 plates. *University Press,* Cambridge, England, 1951. ("... for the general educated reader, who, in the first part, will find an admirably descriptive account of the solar system, which is complete in itself.")

TOPOGRAPHIC SYMBOLS. U. S. Department of the Army. Washington, 1952. (Field Manual 21–31; supersedes FM 21–30 published June 1951.) 111 pages.

A PROSPECT OF CITIES; BEING STUDIES TOWARDS A HISTORY OF TOWN PLANNING. Cecil Stewart. London, *Longmans Green,* 1952. 191 pp., maps.

DEVELOPMENT OF PHOTOGRAMMETRY IN THE U. S. GEOLOGICAL SURVEY. Morris M. Thompson. U. S. Geological Survey, Circular 218. Washington, D. C., 1952.

HOW TOPOGRAPHIC MAPS ARE MADE. U. S. Tennessee Valley Authority, Division of Water Control Planning, Maps and Surveys Branch. 33 pp. 1952.

MANUAL OF PHOTOGRAMMETRY. George D. Whitmore and Others. American Society of Photogrammetry. 2nd Ed., 1952, 876 pp., illus., $12.50.

MAP AND LANDSCAPE. Dorothy Sylvester. London, *G. Philip and Son,* 1952. 287 pp. Maps.

MAP INTERPRETATION. G. H. Dury, with a foreward by A. E. Moodie, and a contribution by H. C. Brookfield. London, *I. Pitman & Sons* (1952). 203 pp. Maps.

MAPS AND DIAGRAMS; THEIR COMPILATION AND CONSTRUCTION. F. J. Monkhouse and H. R. Wilkinson. London, *Methuen;* New York, *E. P. Dutton* (1952). 330 pp., maps. (Dutton advanced geographies.)

MAPS AND DIAGRAMS; THEIR COMPILATION AND CONSTRUCTION. F. J. Monkhouse and H. R. Wilkinson. London, *Methuen and Co., Ltd.,* 1952. (General work on the subject from British point of view. Reviewed in *Annals of the Association of American Geographers,* Volume 42, No. 4, December 1952.)

MAPS; HOW TO READ AND INTERPRET THEM. Toronto, *Clarke, Irwin,* 1952. 64 pp. Maps.

PLANE TABLE MAPPING. Julian W. Low. *Harper & Brothers,* New York, 1952, 365 pp., $5.00. (A field manual useful both as a text and a reference volume.) (Reviewed in SURVEYING AND MAPPING, April–June 1952.)

SURVEY OF KENYA, ADMINISTRATION REPORT, 1951. Colony and Protectorate of Kenya. 17 pp., tables, 3 plates, Nairobi, 1952.

THE LOOK OF MAPS; AN EXAMINATION OF CARTOGRAPHIC DESIGN. Arthur H. Robinson. Madison, *University of Wisconsin Press,* 1952. 105 pp.

THE WORLD ENCOMPASSED; AN EXHIBITION OF THE HISTORY OF MAPS HELD AT THE BALTIMORE MUSEUM OF ART, OCTOBER 7 TO NOVEMBER 23, 1952. (Organized by the Peabody Institute Library, the Walters Art Gallery, the John Work Garrett Library of the Johns Hopkins University in cooperation with the Baltimore Museum of Art. Baltimore, Published by the Trustees of the Walters Art Gallery, 1952. xiv, 125 pp., LX pl., maps.)

UP AHEAD—A REGIONAL LAND USE PLAN FOR METROPOLITAN ATLANTA. Metropolitan Planning Commission, Atlanta, Ga. February 1952. 96 pp., 33 maps and diagrams; folded map in colors in pocket inside back cover. (Thorough planning survey of the city, past and present, and plan for the future.)

—LYMAN D. LYNN

DISTINCTIVE RECENT MAPS

For the reader's convenience, the addresses of publishers and prices of maps are given where this information is available.

—EDITOR

Congressional Districts for the 83rd Congress are outlined on a 1953 map of the United States prepared by the U. S. Bureau of the Census. The map is available from the Superintendent of Documents, U. S. Government Printing Office, at twenty-five cents per copy. The United States map measures 27 by 42 inches and is at the approximate scale of 1:5,000,000. On the same sheet as the main map are 52 inset maps showing Congressional Districts for certain States, counties, and cities where the population densities result in Districts which are too small in area to show on the United States map.

Navigation and Flood Control Projects of the Corps of Engineers are indicated on a map of the United States published in July 1952 by the Chief of Engineers. It was printed by the Army Map Service. At the approximate scale of 1:3,100,000 the map shows harbors and waterways of various depths, locks and dams, reservoirs (completed, under construction, authorized, or under consideration), areas of local protection, levees, and channel improvements. The map is in color and measures 31 by 48 inches. Inset maps show New York Harbor and vicinity, and U. S. territories and possessions.

Domestic and international air routes are shown on a series of black and white maps published in 1951 and 1952 by the Routes and Carrier Relations Division, Bureau of Air Operations, U. S. Civil Aeronautics Board. Included are the following:

International Airline Operations in the Middle American Area, Revised as of June 1, 1951. 25½ by 37 inches.

International Airline Operations in the South American Area, Revised as of June 1, 1951. 36 by 26 inches.

Routes of Foreign Air Carriers Operating to the U. S., September 30, 1952. 11½ by 18½ inches.

International Air Routes of United States Carriers, September 30, 1952. 14 by 20 inches.

United States Air Transportation System Routes Permanently Certificated, September 30, 1952.

United States Air Transportation System Routes Temporarily Certificated to Local Service Carriers, September 30, 1952. 14 by 40 inches.

Territorial Air Routes of United States Carriers, September 30, 1952. 14½ by 20 inches.

The Geological Society of America published in 1952 a large map showing *Pleistocene Eolian Deposits of the United States, Alaska and Parts of Canada.* The map was compiled by the National Committee for the Study of Eolian Deposits, a committee of the National Research Council's Division of Geology and Geography. Various Federal and State agencies, as well as numerous geologists, geographers and other scientists cooperated in compiling the map. Some twenty different deposits of "Wisconsin Loess," "Wisconsin and Older Loess," and "Eolian Sand and Clay" are mapped. Insets include a Schematic Soil Map and a Land-Use Map of North America, and a map of central United States showing the extent of the Loveland (Illinoian Loess). The main map is at the scale of 1:2,500,000 and is printed on two sheets each measuring 48 by 39 inches.

Natural Gas Consumption, Production and Reserves in the United States (as of Dec. 31, 1951) is shown on a map copyrighted in 1952 by Gas Age, 48 West 38th Street, New York 18, N. Y. It was originally issued as a supplement to the October 23, 1952, number of *Gas Age* magazine. Figures for Consumption, Production, and Reserves are given on the face of the map by States and regions. A table reveals "Natural Gas Consumption by Types of Use in United States, Year Ending Dec. 31, 1951." The map, which is uncolored, measures 21½ by 31½ inches and is at the approximate scale of 1: 6,000,000.

"Many of the better known treasure sites of the United States" are located on the *Wild Bill Treasure Map* published in 1952 by Rand McNally and Company. Treasure data was furnished and edited by Thomas H. Penfield. The colorful Treasure Map is illustrated with pictures of pirates, Indians, prospectors, cowboys, monks, and other characters and individuals traditionally associated with lost or buried wealth. It measures 23½ by 35 inches and is at the approximate scale of 1:5,800,000. A slightly smaller (15 by 22 inches) map entitled *Wild Bill Hickock Guide to Lost Treasures* is designed to clarify the main map. The Guide lists "more than 300 of the better known, and some of the lesser known treasure sites of the United States."

Province and Diocese boundaries, and Archdiocesan Sees and Bishoprics of the Catholic Church are shown on a 1952 *Diocesan Map of the United States.* It was published by the Bruce Publishing Company of Milwaukee, Wis. No scale is given on the map which measures 16 by 26½ inches.

A *Literary Map of Iowa* was prepared and published in 1952 for the Iowa Association of Teachers of English. The map was designed by Harriet Larkin and copyrighted by the Extension Division, Iowa State Teachers College, Cedar Falls, Iowa. Similar to literary maps of other States previously published, the face of the map is decorated with sketches reminiscent of the subjects of various literary works or the rural economy of the State. Names of more than 80 literary figures are printed on the map proper or in a table below it. Among the better-known authors are Hamlin Garland, Hartzel Spence, James Norman Hall, Phil Stong, Edna Ferber, Rupert Hughes, and Marquis Childs. The map measures 19 by 23 inches. No scale is given.

The Louisiana Agricultural Extension Service has issued a new reprint (1950) of the map showing *Soil Divisions of Louisiana* originally published in 1935. The map was compiled by the Louisiana Agricultural Experiment Station and published in cooperation with Louisiana State University and A. and M. College and the United States Department of Agriculture. It was printed by Pike Burden, Inc. Nine soil types are differentiated by contrasting colors. The map measurements are 21 by 22½ inches. No scale is given.

A Physical Map of New York State and Adjacent Areas was copyrighted and published in 1951 by the State of New York Department of Commerce. It shows generalized elevations by graded hypsometric tints. Boundaries of administrative divisions and State parks, and transportation networks are shown. Appropriate symbols are used to group communities in five different categories according to population. The map measures 31 by 41 inches and is at the scale of 1:750,000.

Carte Physique Politique et Economique de la Republique d'Haiti (1952) portrays Haiti at the

scale of 1:200,000. It is of wall map size, measuring 47 by 64 inches. The map was drafted by Paul Pereira and designed by Pierre J. Durocher and Hermann Charlot. It shows transportation routes, administrative boundaries, cities, towns, villages, and administrative centers. Brown shading is used to indicate generalized relief. Elevations in meters are given for a number of points. A table gives distances between various cities. The map was printed by the American Map Company of New York. Copies are for sale by B. N. R. H. Bureau de Fournitures, Port Au Prince, Haiti.

A *Map Showing the National Coal Board Divisions* of Great Britain was published recently by the National Coal Board of London. Waterlow & Sons, Ltd., are the printers. Eight divisions, with headquarters indicated, are delimited. The coalfields are outlined within each division. The map measures 12½ by 7¾ inches. No scale is given.

A *Map Showing Inland Waterways of England and Wales* was published in November 1951 by the Docks and Inland Waterways Executive, 22 Dorset Square, London, N. W. 1. It distinguishes waterways owned independently as well as those owned by the I. W. W., those navigable by broad and narrow boats, and those "in regular use," "in occasional use," and "closed and out of use." The map is at the approximate scale of 1:450,000 and measures 32 by 28½ inches.

Generalized relief of *Suomi (Finland)* is shown on a map, at the scale of 1:1,000,000, published in 1951 by Maanmittaushallituksen Kivipaino, Helsinki, Finland. Contours and color tints show elevations ranging from 500 meters below to 1,400 meters above sea level. Administrative boundaries, transportation and communication lines, and other cultural features are also indicated on the map.

Höhensshichtenkarte von Deutschland in den Grenzen von 1937 mit Verwaltungsgrenzen is the title of a new relief map (contours and hypsometric tints) of Germany. It was published in 1952 by der Amtlichen Anstalt für Kartographie und Kartendruck, Berlin SW 68, Wilhelmstrasse 9. The map is printed on two sheets each of which measures 36 by 24 inches. The scale is 1:1,000,000.

The transportation and communications networks of The Republic of Turkey are outlined on several maps published in 1951 and 1952 by the (Turkish) General Directorate of Highways, Planning and Programming Division:

1951 Annual Daily Average Motor Vehicles, Carts and Wagons Flow Map. Numbers of motor vehicle routes are given in red figures, and numbers of carts and wagons in blue figures. Title and legend are in Turkish and English.

Annual Average 1951 Traffic Flow Map. Lines of varying thickness along routes indicate density of flow. Title and legend are in Turkish and English.

The traffic flow lines are also superimposed on a road map of Turkey entitled *Bayindirlik Bakanligi Karayollari Genel Müdürlügü Yol Haritasi.* Symbols differentiate various types of road surfaces. Administrative boundaries are also indicated. Title and legend are in Turkish. This map is also available without the traffic flow overprint.

Türkiye Elektriklendirme Plâni shows power stations and transmission lines. Title and legend are in Turkish.

All of the above maps are at the scale of 1:2,500,000 and measure 11½ by 28½ inches.

The surface drainage of Belgian Congo and Ruanda-Urundi is mapped on the *Carte des Eaux Superficielles.* The map was prepared under the direction of E. J. Devroey and published in Brussels, Belgium, in 1951 by the Institut Geographique Militaire. Towns, villages, transportation routes, and administrative boundaries are shown in addition to various information about the drainage channels and their navigability. Nine drainage basins are delimited. The map is at the scale of 1:5,000,000 and measures 26 by 18 inches.

Distribution of native population in *Tanganyika Territory* is shown in a dot map published in 1952 by the Survey Division, Department of Lands and Mines, Dar-es-Salaam, Tanganyika Territory. Each dot represents 1,000 people. Township names with actual population figures are printed in red on the face of the map. The total native population (1948 Census) is given as 7,410,269. The map is at the scale of 1:4,000,000 with dimensions of 15 by 13½ inches.

The Lands and Survey Department, Wellington, New Zealand, published in 1952 a *Map of the Antarctic Regions* on the stereographic projection. The scale at latitude 60° S. is 1:16,000,000. The Falkland Islands Dependencies, the Ross Dependency, Australian Antarctic Territory, and Adelie Land are delimited. The map measures 28 by 28 inches.

—WALTER W. RISTOW

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The ACSM celebrates its twelfth birthday this month, having held its first meeting on June 16 to 18, 1941, in Washington, D. C. That first meeting was attended by 163 persons interested in surveying and mapping, many of whom are still members.

MAP INFORMATION

This department was inaugurated for the purpose of bringing to the attention of the members information pertaining to the availability of maps, surveys, etc., with particular emphasis on how such material can be procured. Authoritative articles covering this class of information are solicited. It is believed that through an interchange and dissemination of such information maximum benefits will accrue to the surveying and mapping profession.

—EDITOR

Topographic Maps

THE FOLLOWING quadrangle maps were published by the U. S. Geological Survey between December 1, 1952, and February 28, 1953. All maps are available with or without the green overprint which indicates woodland. The quadrangle name is shown in capital letters, followed by the county name in upper- and lower-case letters. Since many quadrangle maps extend into several counties, only that county name is given which contains the place for which the quadrangle is named. For example, the quadrangle SUPERIOR, in *Arizona,* is in parts of Pinal, Maricopa, and Gila counties, but only Pinal is shown because the town of Superior is in that county.

Maps of areas east of the Mississippi River may be ordered from the Chief of Distribution, U. S. Geological Survey, Washington 25, D. C., and of areas west of the Mississippi River from the Distribution Section, U. S. Geological Survey, Denver Federal Center, Denver, Colo.

Alaska

CRAIG (B-1)*—First Judicial Division
CRAIG (B-3)*—First Judicial Division†
CRAIG (B-4)*—First Judicial Division†
CRAIG (C-1)*—First Judicial Division†
CRAIG (C-2)*—First Judicial Division†
CRAIG (C-5)*—First Judicial Division†
CRAIG (D-2)*—First Judicial Division†
CRAIG (D-3)*—First Judicial Division†
CRAIG (D-5)*—First Judicial Division†
JUNEAU (C-3)*—First Judicial Division†
KODIAK (C-2)*—Third Judicial Division†
SITKA (D-7)*—First Judicial Division†

Arizona

SUPERIOR*—Pinal

Arizona-California

CIBOLA*—Yuma

California

BLANCO MOUNTAIN*—Mono
BRADLEY—Monterey
BRYSON—Monterey
BUCKS LAKE*—Plumas
BURNETT PEAK—San Luis Obispo
BURRO MOUNTAIN—Monterey
CONE PEAK—Monterey†
COSIO KNOB—Monterey†
ESPINOSA CANYON—Monterey†
GRASS VALLEY*—Neveda
GREENVILLE*—Plumas
HAMES VALLEY—Monterey†
INDEPENDENCE*—Inyo†
JOLON—Monterey†
KETTLE ROCK*—Plumas
MOOREVILLE RIDGE*—Butte
MOUNT GEORGE—Napa
NAPA—Napa†
NEVADA CITY*—Nevada
PANAMINT BUTTE*—Inyo†
PASO ROBLES—San Luis Obispo†
PILOT CREEK*—Humboldt
PORT SAN LUIS*—San Luis Obispo†
RELIZ CANYON—Monterey†
SAN LUCAS—Monterey†
SAN PEDRO—Los Angeles
SANTA PAULA—Ventura†
SANTA SUSANA—Ventura
SATICOY—Ventura†
TEMPLETON—San Luis Obispo†
THOMPSON CANYON—Monterey
TIERRA REDONDA MOUNTAIN—San Luis Obispo
VILLA CREEK—Monterey†
WAUCOBA WASH*—Inyo†
WUNPOST—Monterey†

California-Oregon

CLEAR LAKE RESERVOIR*—Modoc
MT. DOME*—Siskiyou

Colorado

BRUSH WEST—Morgan†
LEADER—Adams†
LEADER SE—Adams†
LEADER SW—Adams†
MERINO SE—Washington†
MINTURN*—Eagle

Connecticut

BOTSFORD—Fairfield†
MILFORD—New Haven
WESTPORT—Fairfield†

Connecticut-New York

GLENVILLE—Fairfield
NORWALK NORTH—Fairfield

Florida

BABSON PARK—Polk†
CLEARWATER—Pinellas†
LAKE ARBUCKLE NE—Highlands
LAKE ARBUCKLE SW—Highlands†
MALONE—Jackson†
SAFETY HARBOR—Pinellas

Florida-Georgia

BASCOM—Jackson

* Indicates 15-minute quadrangle; all others are 7½-minute quadrangles.
† Indicates map lies wholly within county named.
‡ Indicates availability in either a contour or a shaded-relief edition.

Georgia
BARNESVILLE*—Lamar

Idaho
ELMIRA*—Bonner†
HEISE—Jefferson
HEISE SE—Bonneville†
POPLAR—Bonneville

Idaho-Montana
CLARK FORK*—Bonner

Illinois
EARLVILLE*—La Salle

Indiana
ALLENS CREEK‡—Monroe†
CLINTON—Vermillion
ENGLISH—Crawford†
MANSFIELD—Parke
MECCA—Parke†
MERRIAM—Noble

Indiana-Illinois
FAIRBANKS—Sullivan

Indiana-Kentucky
FLORENCE—Switzerland
NEWBURGH—Warrick
YANKEETOWN—Warrick

Iowa
OSCEOLA*—Clark
ST. CHARLES*—Madison

Kentucky
CANNEL CITY—Morgan
CRANSTON—Rowan
EZEL—Morgan
FLEMINGSBURG—Fleming
GUAGE—Breathitt
HILLSBORO—Fleming
LEE CITY—Wolfe
PLUMMERS LANDING—Fleming
QUICKSAND—Breathitt†
SANDERS—Carroll
SPOTTSVILLE—Henderson†
STRICKLETT—Lewis
TIPTOP—Breathitt

Kentucky-Missouri
WICKLIFFE SW—Hickman

Kentucky-Missouri-Tennessee
BONDURANT—Fulton

Kentucky-Ohio
COVINGTON—Kenton

Kentucky-Tennessee
DOT—Logan
MODEL—Stewart
PRICES MILL—Simpson
ROARING SPRING—Trigg

Kentucky-Virginia
EWING‡—Lee

Louisiana
BELLE CHASSE—Plaquemines

Maine
NORCROSS*—Penobscot

Maryland
BALTIMORE EAST—Baltimore†
BALTIMORE WEST—Baltimore†

Minnesota
BABBITT SW—St. Louis†
CAMPBELL*—Wilkin
CASCO—St. Louis
GILBERT—St. Louis†
KIRK—St. Louis†
MAKINEN—St. Louis†
MANKATO WEST*—Blue Earth
PALO—St. Louis†
VIRGINIA—St. Louis†
WHITE BEAR LAKE EAST—Washington
ZIM—St. Louis†

Minnesota-Wisconsin
STILLWATER—Washington
WABASHA*—Wabasha

Missouri
CENTRAL LAKES—St. Louis†
MOUNTAIN GROVE NORTH—Wright†
MOUNTAIN GROVE SOUTH—Wright
NORWOOD—Wright
OWENS—Wright†

Montana
BELGRADE*—Gallatin
GROSFIELD BRANCH—Sweet Grass†
MOUNT RAE—Park†
RADERSBURG*—Broadwalk
RIMROCK DIVIDE—Meagher†
SIXTEEN—Meagher
SIXTEEN NE—Gallatin
THREE FORKS*—Gallatin

Nebraska
ANSELMO NE—Custer
ANSELMO SW—Custer†
ANSLEY SE—Custer†
ARCADIA SW—Sherman
ARCADIA WEST—Valley
BROKEN BOW SE—Custer†
BROKEN BOW SW—Custer†
CALLAWAY NW—Custer†
LILLIAN—Custer†
MERNA—Custer†

Nevada
CARSON LAKE*—Churchill†
DESERT PEAK*—Churchill†
WEBER RESERVOIR*—Mineral

New Mexico
DIAMOND MOUND—Eddy
SANTA RITA—Grant†

New York
BATAVIA SOUTH—Genesee†
BLOOMVILLE—Delaware†
CANANDAIGUA LAKE—Ontario
CLIFTON SPRINGS—Ontario†
DELHI—Delaware†
HONEOYE FALLS—Monroe
LIVONIA—Livingston†
MACEDON—Wayne
READING CENTER—Schuyler
VICTOR—Monroe

North Carolina
BUNYAN—Beaufort
ENGELHARD EAST—Hyde
GREENSBORO—Guilford
LONG SHOAL POINT—Dare
NEW LAKE SE—Tyrrell
RALEIGH*—Wake
RANSOMVILLE—Beaufort†
RURAL HALL—Forsythe†
SCRANTON—Hyde†
WALKERTON—Forsythe†
WASHINGTON—Beaufort

North Dakota
ANAMOOSE SW—Pierce
BLACK HAMMER HILL—Wells
BORDULAC—Foster†
BORDULAC SW—Foster
BOWDON—Wells†
COURTENAY—Stutsman†
DRISCOLL*—Burleigh
FLORA—Benson
FORT TOTTEN—Benson
GLENFIELD—Foster†
HEATON—Wells†
HEIMDAL—Wells
HESPER—Benson†
HORSESHOE LAKE—Eddy
KENSAL—Stutsman
KENSAL NW—Foster†
KENSAL SE—Stutsman
MARTIN—Sheridan
SELZ NE—Pierce
SELZ NW—Pierce†

Ohio
FRANKLIN—Warren

Oklahoma
COOPERTON*—Kiowa
FORT SILL—Comanche†
JENKS—Tulsa†
MOUNT SCOTT—Comanche†

Oregon
BATES*—Grant
COURTROCK*—Grant
LEABURG*—Lane
POST*—Crook†
SWEET HOME*—Linn

Pennsylvania
FAIRFIELD—Adams†
GALETON*—Potter
RENOVA EAST*—Clinton
WERNERSVILLE*—Berks

South Dakota
BELVIDERE—Jackson
BIXBY—Perkins†
CEDARBUTTE NE—Mellette†
CEDARBUTTE NW—Mellette†
MURDO SW—Jones†
NEWELL—Butte†
OKATON SW—Jones
PASS CREEK NE—Washabaugh†
PASS CREEK NW—Washabaugh
STAMFORD SE—Jackson
STAMFORD SW—Jackson
VALE NE—Butte†
VOLUNTEER SE—Butte
WANBLEE NE—Washabaugh

Tennessee
BUMPUS MILLS—Stewart†
CHESTERFIELD—Henderson†
CHESTNUT GROVE—Perry†
CLARKSBURG—Carroll
HOLLADAY—Benton
JEANETTE—Decatur
LEXINGTON—Henderson†
LINDEN—Perry†
LOBELVILLE—Perry
MISTON—Dyer
NEW PROVIDENCE—Montgomery†
PARSONS—Decatur
PERRYVILLE—Decatur
PINE VIEW—Perry†
SCOTTS HILL—Henderson
STANTON—Haywood
YUMA—Carroll

Texas
BAY CITY—Matagorda†
BLESSING—Matagorda†
CAPLEN—Galveston†
DICKINSON—Galveston†
FLAKE—Galveston†
GALVESTON—Galveston†
INEZ—Victoria
INEZ NW—Victoria†
OSO CREEK*—Nueces
OSO CREEK NE—Nueces†
OSO CREEK NW—Nueces†
PALACIOS NE—Matagorda†
PORT BOLIVAR—Galveston
TEXAS CITY—Galveston
VINCENT—Howard

Texas-Louisiana
ORANGEFIELD—Orange
WEST OF GREENS BAYOU—Cameron

Utah
AVON NW—Iron†
JORDAN NARROWS—Salt Lake
LEHI—Utah
MORONI*—Sanpete
NEPHI*—Juab†

Virginia

GLOUCESTER—Gloucester†
GOODE*—Bedford
GRESSITT—King and Queen
HARRIS GROVE—York
NEWPORT NEWS—Warwick
NORGE—James City
PORT ROYAL—Caroline
RAPPAHANNOCK ACADEMY—Caroline
TOANO—James City
WILLIAMSBURG—York

Virginia-West Virginia

WAITEVILLE*—Monroe

Washington

VAN ZANDT*—Whatcom†

West Virginia-Maryland-Pennsylvania

HANCOCK—Washington

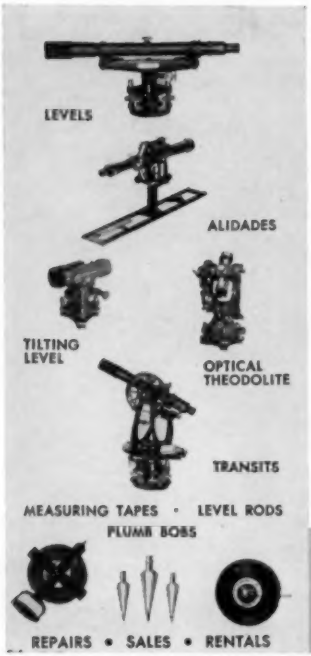
Wyoming

BENTON BASIN NE—Natrona†
BLACK ROCK GAP—Fremont†
CASPER—Natrona†
DEEP LAKE*—Park†
EMIGRANT GAP NW—Natrona†
ETHETE—Fremont†
HIDDEN VALLEY—Fremont†
McCLEARY RESERVOIR—Natrona
MULE BUTTE—Fremont
PAVILION SE—Fremont
PINE MOUNTAIN SW—Natrona†
REID CANYON—Natrona†
SAVAGE PEAK—Natrona
SQUARE TOP BUTTE—Natrona†
WHEATLAND NE—Platte†
Y U BENCH NE—Park

In addition to the standard series of quadrangle maps, reconnaissance maps at the scale of 1: 250,000 are being published for both the continental United States and Alaska. Maps in this series published in the period include the following:

Alaska

AFOGNAK—Third Judicial Division†
CHANDALAR—Fourth Judicial Divis on†
CHIGNIK‡—Third Judicial Division†
DIXON ENTRANCE—First Judicial Division†
GOODNEWS‡—Fourth Judicial Division
HAGEMEISTER ISLAND—Third Judicial Division
ILIAMNA‡—Third Judicial Division†
KODIAK‡—Third Judicial Division†
POINT HOPE—Second Judicial Division†
STEPOVAK BAY—Third Judicial Division†
SUTWICK ISLAND‡—Third Judicial Division†
YAKUTAT‡—First Judicial Division†



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Comment and Discussion

The pages of SURVEYING AND MAPPING are open to a free and temperate discussion of all matters pertaining to the interests of the CONGRESS. It is the purpose of this Department to encourage comments on published material or the presentation of new ideas in an informal way.

—EDITOR

LOCAL SURVEYOR GETS OFF THE BACK SEAT

W. P. JOHNSON†—Please find enclosed check for membership dues for the present year. Frankly, I had decided not to continue membership in the Congress, until the January–March issue of SURVEYING AND MAPPING arrived in the mail. However, a quick glance through the pages gave me new life.

During my "freshman" year as a member of the Congress, I noticed quite a number of articles of a contradictory nature by those who apparently felt it their duty to give their fellow surveyors the benefit of their "utopian ideology" through publishing same in SURVEYING AND MAPPING. One instance is the manner in which some of these swivel-chair experts do great wonders with the magnetic compass, lines and bearings to 1-minute accuracy, and so on.

Most surveyors in this vicinity, as well as in other parts of the country, find the compass a very useful and sometimes necessary part of the transit, but the wise ones do not expect it to perform 1-minute miracles. Also, to my way of thinking, we have extremists on the other end. Nothing but State plane coordinates should be used, to hear some of them.

A good transit survey with iron pipe to a depth of 5 feet at each point will give excellent results for many years, or at least until the property value merits a survey based on the geodetic system, or, as usually happens in Georgia under our law—which is just, I think—the survey is altered by acquiescence on the part of the owners over a period of years to the extent that the survey is of no meaning even though a sufficient number of the iron pins or pipes can be recovered to relocate every line and corner of the original survey.

Why, then, all the hullabaloo over super-super accurate work on everyday surveying by some whose specialty is geodesy? Now geodesy is of untold value and, where properly applied, is a necessity but not a must or even to be urged upon land owners who by their very nature and through their legislators have decided that faith and belief are more important than that which the surveyor finds or of which the mathematician speaks.

But getting back to the Congress and SURVEYING AND MAPPING, let us have more of value in editorials and articles for the benefit of the little fellow and not a preponderance of stardust. After all, the public judges the profession by the men they see and know and not by the big fellow who is a thousand miles away doing a great job but unseen and rarely heard of.

The issue which I have just received is a step in the right direction and I believe the best I have seen.

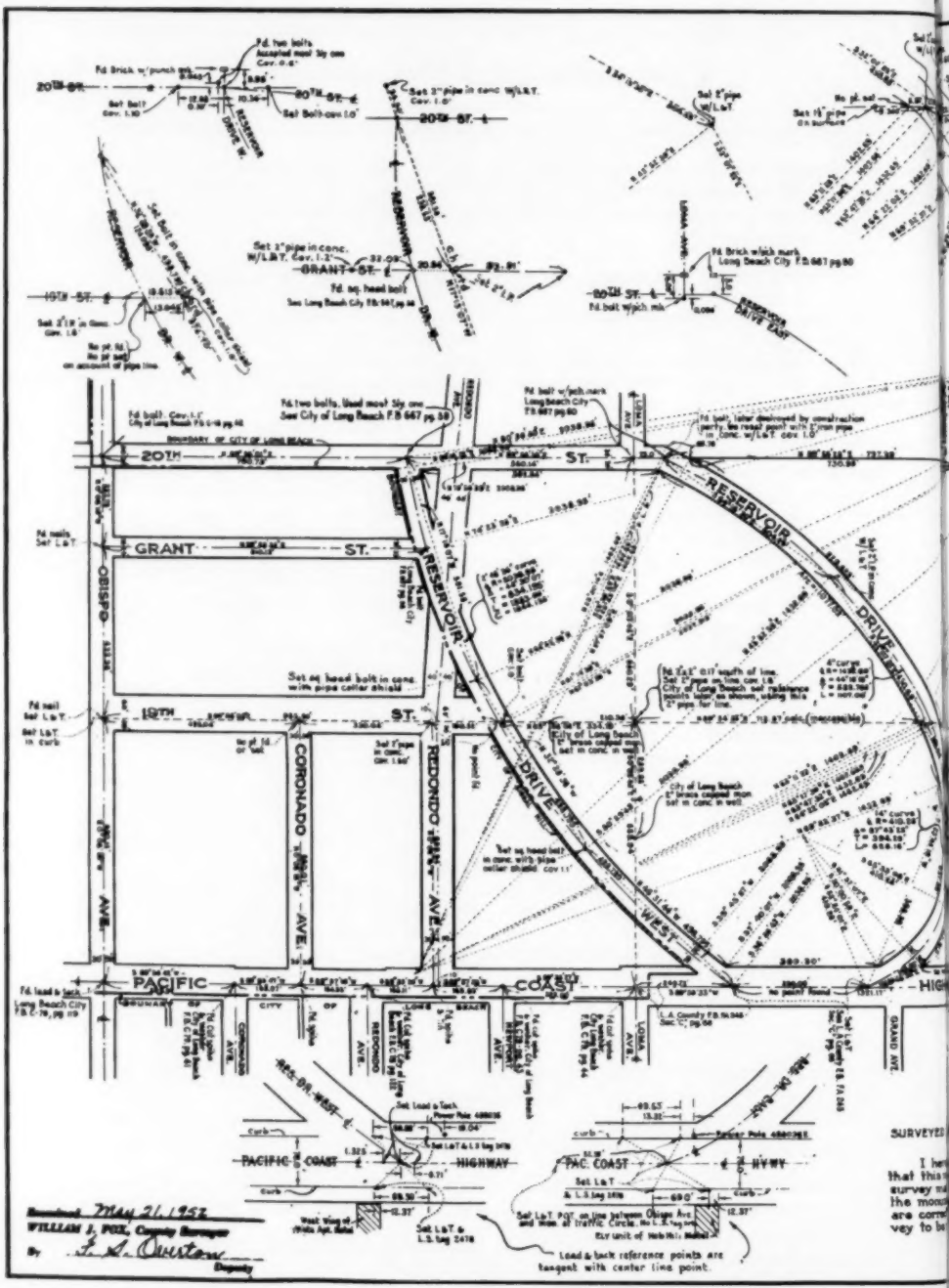
In conclusion, let me say that it is my belief that anything worth building must have a good roof, but if the profession of surveying and mapping is to attain distinction in the eyes of the people, the local surveyor must be a good brick at the bottom or the building will never stand. I am afraid that he has been given a back seat so often that he has lost color and is afraid to venture into the light of organization.

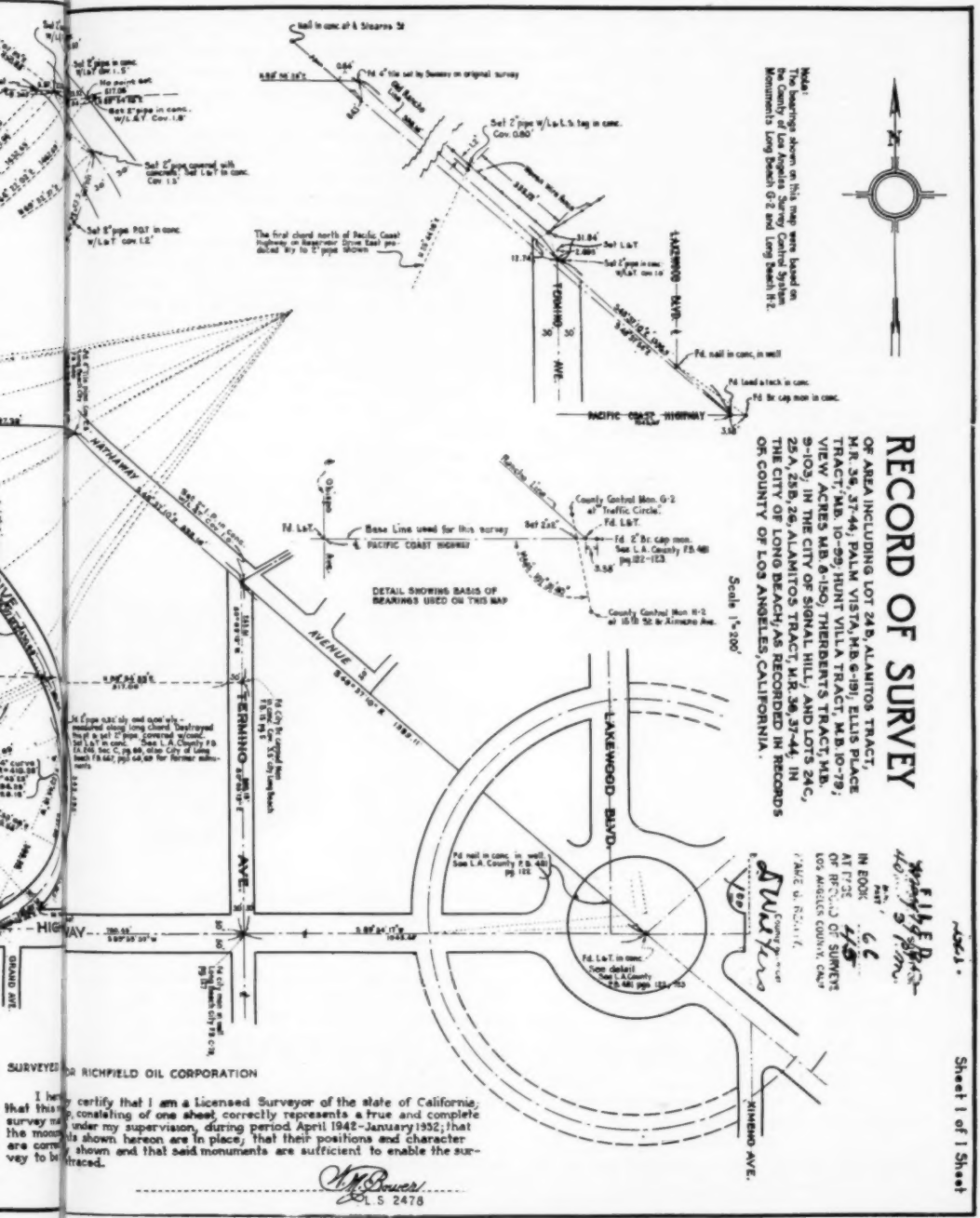
† Registered Land Surveyor, Winston, Ga.

HIGH ACCURACY WITH TRANSIT AND STEEL TAPE

W. M. BOWER*—As you are interested in accurate surveying, I am enclosing under separate cover a copy of a map showing a survey I recently completed and which has been recorded in Official Records, Los Angeles County, Calif. (*See* illustration on the following two pages). Attendant you will also find photostat copies of traverses, and data sheets showing dis-

* Licensed Surveyor, Los Angeles, Calif.


20TH ST.
GRANT ST.
19TH ST.
RESERVOIR DRIVE
RESERVOIR DRIVE WEST
CORONADO AVE.
REDONDO AVE.
OBISPO AVE.
PACIFIC COAST HIGHWAY
Set 2" pipe in conc. W/L.S.T. Cov. 1.2'
Fd. two bolts Used most Sly one See City of Long Beach P.B. 647 pg. 58
Fd. bolt, Cov. L.C. City of Long Beach P.B. 6-18 pg. 45
Fd. bolt w/pch. mark Long Beach City P.B. 647 pg. 60
Fd. bolt, later destroyed by construction party, No reset point with 2" iron pipe in conc. w/L.S.T. cov. 1.0'
Fd. nails, Set L.S.T.
Set sq. head bolt in conc. with pipe collar shield
Fd. nail Set L.S.T.
Set L.S.T. in curb
Fd. 3/4" I.P. 0.11' south of line Set 2" pipe on line, cov. 1.0 City of Long Beach, Set reference points, later destroyed, as shown, using this 2" pipe for line.
City of Long Beach 3" brass capped monument, Set in conc. in well.
Set sq. head bolt in conc. with pipe collar shield cov 1.1'
Fd. lead & tack Long Beach City P.B. 7-79, pg. 19
Set Lead & Tack
Power Pole 6880768
Set L&T & L.S. tag 2478
Set L&T P&T on line between Obispo Ave. and Ave. at Traffic Circle, No L.S. tag on this unit of Mobilio Added
Lead & tack reference points are tangent with center line point.
Recorded May 21, 1952
WILLIAM J. POX, County Surveyor
By L. L. Quinton
Deputy


RECORD OF SURVEY
OF AREA INCLUDING LOT 248, ALAMITOS TRACT, M.R. 36, 37-44, PALM VISTA, M.B. 6-191, ELLIS PLACE TRACT, M.B. 10-99, HUNT VILLA TRACT, M.B. 10-79; VIEW ACRES M.B. 6-150; THERBERTS TRACT, M.B. 9-103, IN THE CITY OF SIGNAL HILL, AND LOTS 24C, 25A, 25B, 26, ALAMITOS TRACT, M.R. 36, 37-44, IN THE CITY OF LONG BEACH, AS RECORDED IN RECORDS OF, COUNTY OF LOS ANGELES, CALIFORNIA.
Scale 1"=200'
Note: The bearings shown on this map were based on the County of Los Angeles Survey Control System Monuments Long Beach G-2 and Long Beach H-2.
DETAIL SHOWING BASIS OF BEARINGS USED ON THIS MAP
Base Line used for this survey
PACIFIC COAST HIGHWAY
LAKEWOOD BLVD.
TERMINO AVE.
AVENUE "S"
RIMENO AVE.
Sheet 1 of 1 Sheet
SURVEYED FOR RICHFIELD OIL CORPORATION
I hereby certify that I am a Licensed Surveyor of the state of California; that this map, consisting of one sheet, correctly represents a true and complete survey made under my supervision, during period April 1942-January 1952; that the monuments shown hereon are in place; that their positions and character are correctly shown and that said monuments are sufficient to enable the survey to be retraced.
L S 2478

tances and angles obtained in the field and those finally used on the map. [The editor regrets that only the map can be reproduced here.] You will note that only very slight adjustments were necessary.

Twenty-nine traverses of the various parcels were computed and all close to less than 0.01 foot. Twenty-one of them close to less than 0.005 foot. The adjusted closure of the boundary is North 0.003 foot and West 0.003 foot.

I feel that this survey is a good example of the high degree of accuracy which can be attained by the use of the ordinary engineer's transit and steel tape. A number of different tapes were used on this job.

The terrain covered is quite rough and, in some cases, sights of less than 200 feet had to be taken. The traffic in this area is some of the most congested in California, making precise work very difficult.

Standardized tapes and tension balances were used, and correction for temperature was made. To eliminate, as much as possible, the use of plumb bobs, measurements were made by slope chaining; but chaining bucks were not employed. To prevent fluctuations caused by wind currents created by traffic, heavy plumb bobs, up to 32 ounces, were used at the transit and shielded in set-ups.

The closed horizon method of turning angles was employed and care was exercised in selecting good weather conditions for observations. A Berger transit, reading to 20 seconds, was used.

As this survey established important property lines and reestablished the city boundary and several streets, unusual care was taken in its execution. Used as a fill-up job, a long time-interval was covered by the survey.

Perhaps you can find room in your excellent magazine for a reprint of this map and the data set forth by this letter, for there are doubtless many readers who would be interested in the matter.

I am a member of the national ACSM and also of the Southern California Section.

❦ ❦ ❦

We're Proud Too

In its issue of February, 1953, the *New Zealand Surveyor* points with pardonable pride, as follows:

"*Surveying and Mapping*, the journal of the American Congress on Surveying and Mapping runs a column in which it refers its readers to current surveying literature. Our own journal has got in recently, in connection with Mr. R. P. Gough's able account of the procedures and methods employed at Reparoa on the survey and topographic mapping of the Rotorua pumice lands."

Thank you, *New Zealand Surveyor*. We are equally proud to be mentioned in your columns.

❦ ❦ ❦

M. I. T. Highway Conference

A three-day professional conference on Modern Highways will be held on June 23, 24, and 25, at the Massachusetts Institute of Technology as part of the conference and symposia program of the 1953 Summer Session at the Institute.

Each day of the conference will be devoted to a different phase of the major topic.

The program on Tuesday, June 23, will emphasize Planning. It will consider the gathering of traffic data, preparation of master plans, route selection, and the place of highway development in regional planning.

The program on Wednesday, June 24, will emphasize Survey. It will include the use of aerial survey data in highway planning, the interpretation of air photographs for soils studies, and the application of soil surveys to highway location problems.

The program on Thursday, June 25, will emphasize Design. It will review design standards, the relation of design to traffic capacity and safety, and the application of design to traffic relief in both the smaller and larger community.

The conference is being sponsored jointly by the Departments of Civil and Sanitary Engineering and of City and Regional Planning at M. I. T., and by the Massachusetts Department of Public Works.

Army Engineers Test Helicopter Triangulation

SURVEYING TESTS using helicopters over a 3,000 square mile area of barren terrain between Phoenix and Tucson, Ariz., began February 1, the U. S. Army Corps of Engineers recently announced. The Helicopter Survey Test, staffed by approximately 30 men, mostly civilians, is a project of the Engineer Research and Development Laboratories, Fort Belvoir, Va.

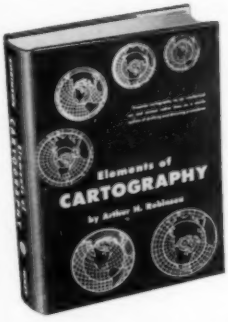
The purpose of the test is to determine the feasibility of triangulation surveys across inaccessible terrain by simultaneous observations on a helicopter from several ground stations. Since most of the test is conducted at night, a light suspended below the helicopter is used as an observing target.

Triangulation stations from which observations are made were previously established in the rear and forward areas by the U. S. Coast and Geodetic Survey. By employing two-way radio communication, ground observers can make simultaneous determinations of directions from their stations to the helicopter with precision survey instruments.

The results of the test—longitudes, latitudes, and elevations—are checked against previously determined results arrived at by conventional survey methods.

Field headquarters for the test is located at Casa Grande, Ariz. The area selected for the test is about 30 miles wide and about 100 miles long.

Just published . . . a 'must' for all concerned with map-making



Elements of CARTOGRAPHY

By ARTHUR H. ROBINSON, *University of Wisconsin*
During World War II, Chief of the Map Division, OSS

This big new book approaches the subject of medium and small-scale mapmaking from the point of view of basic ideas and their practical applications. It is complete, well organized, and written in an enjoyable style rare among books of its kind.

New techniques developed under wartime pressures are included. Other innovations include chapters on important subjects rarely covered in books on cartography, such as map design, lettering, and statistical cartography. The author explains thoroughly the functions of projections, discusses the various types, and shows how to select and construct projections for any particular need. He keeps such factors as distortion always in mind, and provides ample illustrations of them.

Chapter headings

The Art and Science of Cartography
The Earth and the System of Coordinates
The Employment of Map Projections
The Construction of Projections
Drafting Materials and Map Reproduction
Compiling and Preparing the Map Base
Map Design
Map Lettering
Symbolization and Distribution Maps
Representing the Terrain
Appendix, Bibliography, Index

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News of Related Organizations

Indiana Land Surveyors Organize

As reported in the January–March issue, 65 land surveyors and engineers interested in the problems of the land surveyor attended the First Annual Indiana Land Surveyors' Conference held at Purdue University, West Lafayette, Ind., on January 14 and 15, 1953. We can now state that, at the conclusion of the conference, the group organized the Indiana Society of Registered Land Surveyors to provide for the planning of future programs and activities of value and assistance to the practicing land surveyor. William J. Boatright, Putnam County Surveyor, of Greencastle, Ind., was elected President of the Society. Other officers elected include Vice President Sam Brownsten, Lake County Surveyor, of Crown Point, Ind.; and Secretary-Treasurer Charles Condra, Floyd County Surveyor, of New Albany, Ind. W. E. Camp and K. S. Curtis of Purdue University were appointed to an Advisory Committee to develop a constitution and by-laws to be voted upon by the membership.

ALFRED C. STIEFEL

Michigan Society of Registered Land Surveyors Meets

The Twelfth Annual Meeting of the Michigan Society of Registered Land Surveyors was held at Traverse City, Mich., on Feb. 5, 6, and 7, 1953. George D. Henning, President for the past year, presided. The program included a full day of discussions of common problems of the surveyor, the attorney, and the abstractor. This part of the meeting was held in conjunction with the Michigan Bar Association and the Michigan Title Association, and S. J. E. Lucas, Maintenance Superintendent of the Michigan Highway Department, served as moderator.

Leo V. Nothstine, Associate Professor in the Department of Civil Engineering at Michigan State College, East Lansing, Mich., was recently elected president of the Michigan Society of Registered Land Surveyors for next year. Other officers elected include John McMahon, Vice President; John D. Lehner, Secretary; and S. J. E. Lucas, Treasurer.

News Notes

The American Society of Photogrammetry announced on February 18 the naming of C. E. Palmer of Washington, D. C., as Secretary-Treasurer.

Mr. Palmer had been purchasing agent for the Red Cross national headquarters at Washington, and previously was a Red Cross field director in Alaska. For several years before that he was associated with the Celotex Corporation of Chicago.

As Secretary-Treasurer, Mr. Palmer will be responsible for organizing, establishing, and administering the new National Headquarters office of the Society in Washington.

The Fédération Internationale des Géomètres-Experts et Topographes has announced plans for a congress and exposition to be held at The Sorbonne, Paris, France, from August 28 to September 5, 1953. Those who are interested may obtain additional information by writing to Service Publicité de l'Exposition, Maison du Géomètre, 3, rue Joseph-Granier, Paris, France.

CONGRESS NEWS

Executive Secretary's Report

This is a time of accelerated progress; improvement is the watchword. It is certainly the watchword of the American Congress on Surveying and Mapping.

It is gratifying indeed to observe the results of ACSM's objective groundwork in bringing the importance of surveying and mapping to the attention of other professional fields and to the public. Several instances have come to notice indicating that individuals and communities are becoming more and more survey- and map-minded. This circumstance is directly and indirectly traceable to the work of the American Congress on Surveying and Mapping. These communities and individuals wish to improve, to progress—and improvement and progress are synonymous with surveying and mapping.

Let me support that remark about improvement and progress being synonymous with surveying and mapping. A few days ago I noticed a full-page advertisement in one of Washington's leading newspapers. Naturally the ad caught my eye because half of the page was a picture of a surveyor sighting through a transit. A great railroad, in an attempt to bring to public attention the very newness of its streamlining and streamliners, uses the surveyor as the theme for its public relations advertisement. This great railroad, of popular song hit fame, is revitalizing, shaking off the old, picking up the new, not haphazardly, but as a planned program. The ad reads, "What is this surveyor doing? He is sighting on tomorrow . . . clipping off the past . . . day after day . . . building new." Then it sums up by saying "Progress that pays its own way." This great railroad knows that improvement and progress are synonymous with surveying and mapping.

May I say that the American Congress on Surveying and Mapping and the surveyor and the cartographer stand today as a definite part of progress—sighting on tomorrow.

In the hope of stimulating alertness and cooperative liaison in keeping with the ACSM's growing national importance, your Secretary is calling a point or two to your attention. Most of you are cognizant, I am sure, of the steady growth of individual membership in ACSM, now numbering over 3,000. Some of you are also aware of the spreading interest in surveying and mapping organizations in various parts of the United States and elsewhere. It is this growing local interest in association by groups interested in surveying and mapping, the grass roots interest, that becomes so important—important to the groups locally, important to ACSM nationally, or internationally, if you like.

Besides the expanded activity of ACSM's local sections—the Southern California Section, the Texas Section, the Northern California Section—there is the increased activity of State and regional groups such as the Georgia Association of Registered Land Surveyors, the Michigan Society of Registered Land Surveyors, the Virginia Association of Surveyors, the Nassau-Suffolk Civil Engineers of Long Island, New York; all these are affiliated with ACSM.

Increased interest is also evidenced in organized activity by the East Bay Council on Surveying and Mapping, out San Francisco and Oakland way in Contra Costa and Alameda counties, Calif.; by the Surveyors' Association of King County, Seattle, Wash.; by the Wisconsin Society of Land Surveyors; by the Indiana Society of Registered Land Surveyors; and by continued activity in Florida, Maryland, and Illinois. All of these are potential affiliates of ACSM.

Expansion of interest such as this increases the importance of association. It also increases the responsibility of association. It is on this point that I wish to focus your attention. To fulfill its responsibility in keeping the Congress, its Board and officers, its corporate and affiliated membership, and the public intelligently informed on all matters of interest to the broad scope of surveying and mapping, ACSM's secretariat at the national level must itself be kept intelligently informed on surveying and mapping affairs at all levels.

That responsibility, my friends, rests with all

of you—officers and secretariats of the divisions, sections, affiliated groups, committees, and even with individual members.

Much objective work of ACSM must be done by dated action and correspondence and committee effort beyond the means afforded by our splendid quarterly publication. May I therefore appeal to all of you to keep close touch with the pulse of ACSM, keep the Secretary informed by some means or another; and whenever you can, send extra copies for distributing along ACSM's active blood stream. Matters that are important one place are often important in other places. That is the value in disseminating information.

WALTER S. DIX
Executive Secretary

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Editor's Report

During the year 1952 the four regular quarterly issues of SURVEYING AND MAPPING, comprising 440 printed pages, were published. Included were 56 principal articles, 58 "filler" items, and 31 advertisements, as well as the recurring departments on "Surveying and Mapping News," "Books in Review," "Map Information," "Comment and Discussion," "Congress News," and the lists of "New Members" and "Sustaining Members."

As a courtesy to authors and other interested members, the Editor's office also handled the preparation and ordering of reprints of 14 articles, including the "Membership Roster" and the 3 subsequent lists of "New Members."

Among the improvements to the Journal made during 1952, three are particularly noteworthy. The type-page has been increased by about 20 percent through increasing the lineal dimensions of the page and through changing the style of type to a somewhat smaller but heavier and more readable face.

The adoption generally of a two-column page has made the Journal easier to read and has led to better page composition.

Perhaps the most noticeable change, however, has been the opening of the pages of SURVEYING AND MAPPING to advertising. Informative, well-prepared advertisements such as those so far published can be of real interest and value to the members.

Speaking for Mr. Shalowitz, who was Editor-in-Chief during the period covered by this report, I wish to express appreciation to the Publications Committee for its cooperation and ability in selecting and preparing papers for publication, and to all the authors who have contributed material.

To Mr. Shalowitz I owe more thanks than mere words can convey. His patience and understanding during the year of my assistantship made the job of learning the work infinitely easier. His editorial ability will serve as a model to me during my tenure of this office. Finally, I think all of us, officers and members alike, owe him a great debt of gratitude for his ten years of service and for the quality of the Journal which he has developed during this time.

ROBERT C. ELLER
Editor-in-Chief

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Membership Committee Report

The paid membership for the calendar year 1952 was 2,910. This was made up of 2,685 individual members, 209 library members, and 16 sustaining members. During the year, 754 new members were added. On the other hand, 331, or 15 percent of the individual memberships, were lost during the same period through deaths, resignations, and failure to pay dues, thereby reducing the gain for the year to 423 members.

Thus far, in the current calendar year, 327 new members have been added, making our

total individual membership 3,012 as of today, March 25, 1953. Combining this with our library and sustaining memberships, we have at the present time a total of 3,250. Assuming the same percentage loss of old members and the same number of new ones in 1953 as in 1952, we should have a total of approximately 3,300 members in good standing at the end of the year.

In view of the obvious need for such an organization as the Congress, with its excellent possibilities for rendering public service, the Committee feels that the annual loss of 15 percent of the membership is far too high. Examination of over 2,000 applications received in recent years shows that the majority of our members are not only keenly interested in one or more branches of surveying and mapping, but are also well aware that the profession as a whole is in much need of a lift. What some of our members, and many who should be members, fail to recognize is that each of them has a responsibility for helping to support this organization which was started, and is being developed, entirely by voluntary effort, to help raise the standards of the profession and improve the status of those who have chosen it as a career. In speaking of support we mean more than the prompt payment of dues. We mean also such services as the submission of articles, news items, short cuts, and suggestions for our Journal; encouragement for the formation of local sections; efforts toward the enactment or strengthening of registration laws; attendance at and participation in local and annual meetings; and finally, selling the desirability of membership in the Congress to prospective members.

In connection with the last-mentioned service, the fourth page of "New Members" in this issue of the Journal carries an application blank. Please cut the entire page from your copy of the Journal and forward it to someone you feel should be a member of the Congress. If additional application blanks can be used to advantage, please request them from the Chairman, Membership Committee, P. O. Box 6244, Washington 15, D. C.

The Membership Committee takes pleasure in presenting, at this time, membership awards to the four following members of the Congress, each of whom has obtained at least 25 new members: Forrest M. Daniell, Houston, Tex.; Arthur C. Miller, vice-president of Michael Baker, Inc., Jackson, Miss.; Francis J. Ortiz, Washington, D. C.; and Paul E. Roth, Los Angeles, Calif.

We believe there are others who have been instrumental in obtaining at least 25 new members, but we regret that we do not have sufficient information to verify our belief. We shall, however, welcome any information from any member who wishes to be considered when next year's membership awards are determined. We wish to express our sincere appreciation to all who have helped us build up the membership of the Congress, and otherwise assisted us at various times and in various ways.

FRANK S. BORDEN
Chairman

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Public Relations Committee Report

During calendar year 1952 the Public Relations Committee was engaged in disseminating information concerning the ACSM—its purpose, its activities, and its meetings. Several meetings of local groups and organizations in the field of surveying and mapping were attended by members of the Committee and reported in SURVEYING AND MAPPING. Many of these activities were carried on through liaison with the officers, directors, and technical divisions of the Congress.

Perhaps the major work of the committee was the publicity for the 12th Annual Meeting held in Washington, D. C., on June 11 to 13, 1952. Although set up as a separate publicity committee the work was actually performed by essentially the same personnel and carried out as a part of the work of the Public Relations Committee.

The ACSM was well represented on the program at the Third National Surveying Teachers' Conference at Blackduck, Minn., in August. The Committee used this occasion to promote the activities of the Congress. Similar public relations activity was done at the Middle Atlantic regional meeting of the American So-

ciety for Engineering Education. Your chairman also had the pleasure of attending an excellent meeting of the Texas Section of the ACSM in Houston, Tex., on May 20, 1952. Such active sections are important factors in maintaining the national scope and interest of the Congress.

The Centennial of Engineering, observed throughout 1952, was climaxed by a ten-day convocation of engineering societies in Chicago, Ill., on September 3 to 13, 1952. The ACSM participation consisted of a luncheon at the Conrad Hilton Hotel and one day of meetings, including discussions regarding the formation of an Illinois Society of Land Surveyors. This Centennial activity was initiated by the Public Relations Committee, in cooperation with the Executive Secretary and Officers of the Society.

The National Headquarters of the Boy Scouts of America was contacted by the Committee concerning the Boy Scout merit badge pamphlet on surveying which outlines the requirements for an achievement award and merit badge in this subject. This pamphlet is in need of revision to bring it up to date and in accord with modern techniques. Map reading should also be included, or made the subject of another manual. This project is one that seems very appropriate for the Congress to sponsor and the BSA headquarters would welcome such cooperation. It is recommended that the Board of Directors consider the appointment of a special committee to take on this project.

Many other activities might be mentioned, including advance publicity for the 1953 Annual Meeting. I wish to give special credit to Capt. F. S. Borden, Chairman of the Membership Committee, and a member of this committee, for his valuable and continuing activities in behalf of the Congress; also to Albert A. Stanley, for his excellent coverage in the *Military Engineer*, and to J. Vance Dobbin, for his coverage of the press and radio.

This report covers the entire calendar year of 1952 up to January 15, 1953, at which time, because of increasing official duties, I found it necessary to resign as chairman of the Public Relations Committee. I have enjoyed the opportunity of serving the Congress as chairman of this committee and have appreciated the honor. The future of the Congress depends in a large measure on the public relations activity of its members, and I will continue to serve the Congress in this field as time and opportunity permit.

ALFRED C. STIEFEL
Chairman

Northern California Section

Admiral Studds, President of the Congress, was speaker at the spring meeting of the Northern California Section held in April at the City College of San Francisco. He presented a very interesting and complete report of the annual convention and a résumé of the duties and functions of the United States Coast and Geodetic Survey. Other business included the election to honorary life membership in the Section of V. S. Seward, first chairman, and the man responsible for the organization of the Section.

The East Bay Council on Surveying and Mapping was endorsed by the Section. This recently organized quasi-official body composed of all organizations engaged in surveying and mapping in the two East Bay counties has assisted the County Surveyors' offices to become central repositories for monument records and data regarding the California Coordinate System. While the primary object is to promote supplementary control surveys and encourage their use, much has been done to standardize methods and procedures and prevent duplication of effort by the many tax-supported agencies. The Council is considering affiliation with the Congress.

"Legal Aspects of Boundary Surveys" was the subject of a course presented by the University of California at the request of the Section's Property Surveys Division. This course, consisting of eight weekly two-hour meetings, is being scheduled for presentation in other parts of the State because of the enthusiastic response it received. Taught by a practicing attorney and former title insurance company counsel, it fills a long felt need in the surveyors' education.

C. A. WOOLDRIDGE, JR.
Section Editor

Southern California Section

At its first meeting of the year on January 14, 1953, the Executive Board of the Southern California Section adopted a tentative program for the year, which includes Section meetings on March 12, June 2, and September 29; a field day on April 21; a technical meeting on either October 31 or November 7, and a banquet and election on December 8.

At this same meeting the Section presented Certificates of Honorary Membership to Howard Saunders and William C. Wattles.

At another meeting of the Executive Board on February 10, Chairman Henry H. Beitler reported that a request had been received by Ben O. Badgley, Chief Surveyor, City of Los Angeles, from El Camino Junior College for suggestions and recommendations in regard to courses of study for a surveying curriculum. Chairman Beitler expressed great satisfaction in the growing respect for the surveying profession evidenced by such an inquiry.

The March 12 Section meeting was in the form of a dinner meeting. There were 65 members present. The speaker for the evening was William Cook, of the firm of John H. Davies, Consulting Engineer, Long Beach, Calif., who presented a highly interesting and instructive talk on the "Application of Photogrammetry to the Terminal Island Subsidence Problem." Mr. Cook was well armed with facts and equipped with numerous charts, maps, photographs, and slides on his subject with the result that his presentation was thoroughly enjoyed.

On April 21 a general field night was held at Griffith Park Recreation Center, featuring an outdoor supper followed by field demonstrations of precise taping and night triangulation procedure. Following this, members and guests heard technical papers on "Development of Los Angeles City and County Grid Systems," by Henry Thompson, and "Practical Application of Coordinates to the Layout of the Three Mile Outfall Sewer Tunnel," by Alfred Boysen. Both men are survey supervisors for the City of Los Angeles. The final event of the evening was a panel discussion on "Triangulation Techniques" led by H. Fred Peterson, Manager, Survey and Drafting Department, Shell Oil Company.

The meeting was arranged under the direction of Ben O. Badgley.

There are indications that surveyors and cartographers in Southern California, as in other sections of the country, are becoming increasingly conscious of the importance of better surveys. Many of the Section's members in private practice are already engaged in projects entailing a high order of accuracy; others, both privately and publicly engaged, have expressed interest in securing first-hand knowledge of precise procedure.

LEIGHTON KEELING
Secretary

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Reprints of Articles

Reprints may be obtained of any article appearing in this issue. Orders must be placed with the Editor-in-Chief not later than 3 weeks after publication. Authors who wish reprints of their articles may so indicate when manuscripts are submitted. The minimum reprint order is 50 copies. Approximate prices of 4- and 8-page reprints follow:

	Self-Cover		*Heavy Paper Cover*	
No. of copies	*4 pp.*	*8 pp.*	*4 pp.*	*8 pp.*
50	$12.01	$19.59	$19.08	$26.66
100	$12.48	$20.43	$21.43	$29.38
250	$13.95	$22.94	$28.54	$37.53
1000	$21.30	$35.46	$64.09	$78.25

Texas Section

The officers and directors of the Texas Section of ACSM convened on January 7, 1953, at the Houston Engineers' Club, with Section Chairman E. D. Morse presiding. Mr. Morse read the names of the officers elected for 1953 and announced the appointment of L. P. Carr, of the Shell Oil Company, as Treasurer to replace H. Alton Allen who was unable to serve. (The complete list of Texas Section officers, except directors, appears in the January–March 1953 issue. The directors include J. A. Tomlinson, L. E. Cornitius, R. K. Daley, O. E. Young, J. O. Phillips, and R. L. Sargent.—Ed.)

Mr. Morse announced the appointment of the following committee chairmen:

W. H. Wilson, *Program*
R. A. Washburn, *Membership*
L. E. Cornitius, *Arrangements*
Forrest M. Daniell, *Public Relations*
O. E. Young, *Nominating*
J. O. Phillips, *Civic and Regional Affairs* (Special Committee).

Also announced were the appointment of Forrest M. Daniell as Section Editor and the election of G. W. Herzog as National Director for a two-year term.

The duties and responsibilities of the Secretary, the Treasurer, and the Membership Committee were discussed. Among other things, it was decided that the Secretary should prepare and send semi-annually to each member an up-to-date roster with a list of officers and committee chairmen. A motion was passed to present membership cards to each Texas Section member for dues receipts.

The possibility of inauguration of student chapters was discussed. The Secretary was requested to inform the National Organization of the Texas Section's interest in student chapters, and, as a step to increase student activity, to send notices of Section meetings to the Engineering Departments of Rice Institute and the University of Houston.

The eighth meeting of the Texas Section was held on February 20, 1953, at Houston, with W. H. Wilson, Chairman of the Program Committee, presiding.

Louis A. Woodward, Vice President of Jack Ammann, Photogrammetric Engineers, San Antonio, gave a paper on "Photogrammetric Mapping." Mr. Woodward is a member of the Texas Section and is active in the national organization, having participated in a panel discussion on contour intervals for topographic maps held at the 1952 annual meeting in Washington. (This panel discussion was published in the October–December 1952 issue of SURVEYING AND MAPPING.—Ed.) Mr. Woodward illustrated his talk with slides and examples of maps produced by aerial photogrammetry. He said that time, cost, and accuracy were the three criteria in planning an aerial survey. He also pointed out that, while aerial photographs become obsolete due to various changes, surveyors often request old photographs to distinguish land lines which have since become obliterated.

Joe Battle, an engineer with the Houston Urban Expressways Division of the Texas Highway Department, discussed applications of aerial photogrammetry in connection with proposed superhighways in Houston. Mr. Battle pointed out that the use of aerial photographs for preliminary right-of-way location does not cause the general public to become excited, as so often happens when the preliminary location work is done by ground surveys.

E. D. Morse, Section Chairman, discussed the Thirteenth Annual Meeting at Washington and stressed the benefits obtained by surveyors and mappers in attending these meetings. He also discussed the Surveyors Licensing Law which was introduced in the Texas Legislature the previous week.

The ninth regular meeting of the Texas Section of the American Congress on Surveying and Mapping was held on May 8, 1953, at Houston, Tex. The feature of the evening was a talk on "The Importance of General Recognition, Occupation, and Limitation in Fixing Land Boundaries" by Clayton Orn, Attorney for the Ohio Oil Company and a widely recognized authority on Texas land problems. W. H. Wilson was in charge of the program.

G. W. Herzog, past Chairman of the Texas Section suffered a heart attack the week following his return from the Annual Meeting in Washington and was confined to the hospital for two or three weeks. Although he is greatly improved it is necessary for Mr. Herzog to limit his activities.

FORREST M. DANIELL
Section Editor

Resolutions Adopted at Thirteenth Annual Meeting

The following Resolutions were unanimously adopted by the American Congress on Surveying and Mapping at the Thirteenth Annual Meeting at Washington, D. C., March 25, 1953.

RESOLUTION IN REMEMBRANCE OF PROFESSOR BOUCHARD

Resolved, that the American Congress on Surveying and Mapping expresses its deepest sorrow at the passing of Prof. Harry Bouchard, a leader and strong supporter of the Congress from its first inception and an active participant in other national engineering societies and professional organizations; and that the Congress extends its heartfelt sympathy to his family in their bereavement and to the University of Michigan in its loss of a great pioneer in surveying and engineering education and a beloved professor and teacher to thousands of students, many of whom are members of this Congress; and be it further resolved that a copy of this resolution be forwarded to the family of our late member and friend.

RESOLUTION OF APPRECIATION TO A. L. SHALOWITZ FOR DISTINGUISHED SERVICE AS EDITOR-IN-CHIEF

Whereas, Aaron L. Shalowitz has performed the duties of Editor-in-Chief of SURVEYING AND MAPPING, the Journal of the American Congress on Surveying and Mapping, from its first issue in 1943 until the last issue in 1952; and

Whereas, Mr. Shalowitz has executed the responsibilities of that office with high distinction and consummate skill; and

Whereas, during Mr. Shalowitz' tenure of the office of Editor-in-Chief, SURVEYING AND MAPPING has progressed from a relatively little-known publication to a position of world-wide influence and authority in its field and has become a source of pride to all members of the Congress; and

Whereas, this office has, at Mr. Shalowitz' request, been passed on to another Editor-in-Chief; now, therefore, be it

Resolved, that the Congress express, by a rising vote of thanks, its gratitude to Aaron L. Shalowitz for his many years of voluntary service as Editor-in-Chief, and further that a copy of this resolution be printed in the Journal of the Congress.

RESOLUTION ON SURVEYING AND MAPPING EDUCATION

Resolved, that the American Congress on Surveying and Mapping favors the establishment in colleges and universities of a course of studies leading to the degree of Bachelor of Science in the field of surveying and mapping; and that the ACSM Education Division be authorized and requested to question representative surveying and mapping agencies and private concerns in order to formulate a recommended curriculum realistically geared to actual needs.

RESOLUTION ON THE THIRTEENTH ANNUAL MEETING

Resolved, that the members of the American Congress on Surveying and Mapping consider this Thirteenth Annual Meeting to have been extremely successful and unanimously convey their very sincere appreciation to the General Chairman, Murray Y. Poling, and to the members of his committees and to all those who have worked to such excellent effect in scheduling and presenting this meeting.

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Sixty-first Annual Meeting of Association of Ontario Land Surveyors

The writer had the privilege and the honor of being invited by Col. A. L. S. Nash, president of The Association of Ontario Land Surveyors, to attend their Sixty-first Annual Meeting on February 17 and 18, 1953, at the Royal York Hotel in Toronto, Ont., as the guest of S. W. Archibald. Mr. Archibald is a well known member of the American Congress on Surveying and Mapping, and a past-president of the Association of Ontario Land Surveyors. Among other guests were Wilfred Humphreys, an ACSM member, and past-president of the Canadian Institute of Surveying and Photogrammetry; also that grand old man of Montreal, Charles C. Lindsay, ACSM's advisory councilor in Canada who is so well known to Congress members with esteem and affection.

The meeting was of maximum interest. It differed in form from those generally held in this country, in that the papers presented consisted almost entirely of reports of various committees. The unusual feature of these reports was that

one or more problems presented by the members to the committee during the year were submitted with each report. The committee, whether it was the Committee on Land Surveys, or Engineering Roads & Pavements, or Drainage, would study the problem, and analyze it in respect to the standards and regulations, and report a recommended solution. This recommended solution would be submitted for adoption at the meeting. Then there followed a thorough discussion of the problem from the floor, and a vote was finally taken on each question, based upon the recommendation and the discussion that developed.

The Annual Report of the Association will contain a full transcript of the reports, discussions, and findings, together with the diagrams and illustrations used in the presentation.

Although these findings apparently carry no official weight, they do serve the admirable purpose of furnishing a realistic example, particularly to younger members, of the process of study and analysis of problems of various types that occur in survey practice in the Province.

The writer was treated with the utmost consideration and kindness. The name of the American Congress on Surveying and Mapping was constantly mentioned in highest praise. Several Association members approached the writer to express the opinion that the Journal of the Congress is the best publication on surveying, particularly land surveying, that has come to their attention. It is extremely gratifying to find the warm and enthusiastic welcome across the border for the Congress and its activities.

SOL A. BAUER

Personals

John P. Goggin, C. E., of Marathon, Fla., an ACSM member who in recent years has been especially active in Property Surveys Division affairs, was featured in a full-page illustration on the front cover of *International Blue Printer* for January 1953.

The February 1953 issue of the *New Zealand Surveyor* reprints from SURVEYING AND MAPPING a paper delivered at the Twelfth Annual Meeting of ACSM—"Shoran Operations in Canada," by J. E. R. Ross, Dominion Geodesist.

The Personal pages of this Journal of The New Zealand Institute of Surveyors contains further news of ACSM friends and members. According to Mr. Ross and Georges Côté, who is a Quebec member of ACSM, New Zealand's Surveyor General, R. G. Dick, an ACSM member who spoke at the Eleventh Annual Meeting, has been dubbed "The Surveyor's Apostle" by Quebec surveyors. This appelation has a deep significance, according to Mr. Ross.

Howard S. Rappleye, one of the charter members of the American Congress on Surveying and Mapping, retired from the U. S. Coast and Geodetic Survey on March 31, 1953, after more than 36 years' service with the Bureau.

During his long career he made many contributions to the field of surveying and mapping. While serving in the Philippine Islands, he executed a scheme of triangulation for the city of Manila and environs. He wrote numerous articles and papers, the most notable being "Precision Leveling at the White House." He authored many Coast and Geodeteic Survey publications including the Manual of Geodetic Leveling and the Manual of Leveling Computation and Adjustment.

In 1950 he was awarded the Department of Commerce Meritorious Service Award for outstanding service.

Mr. Rappleye was succeeded as Chief of the Section of Leveling by James B. Small.

The American Congress on Surveying and Mapping was officially represented by Georges Côté at the annual meeting of the Corporation of Quebec Land Surveyors, held at Quebec City on April 15 and 16. In a short address, Mr. Côté presented the good wishes of the ACSM, outlined the aims of the organization, and summarized recent Congress activities.

Obituary

On Saturday, March 21, 1953, Prof. Harry Bouchard suffered a fatal heart attack just after arriving at the National Airport in Washington, D. C., to attend the Thirteenth Annual Meeting of the American Congress on Surveying and Mapping.

Born in Michigan City, Ind., on February 1, 1889, Professor Bouchard graduated from Detroit Central High School in 1906 and received a B. C. E. degree from the University of Michigan in 1911.

After graduation, he spent about three years as instrumentman and draftsman on the Stevens Creek hydroelectric development near Atlanta, Ga., and about a year as draftsman and assistant resident engineer on the construction of a storage reservoir near Duluth, Minn. He then worked for about a year and a half on preparing maps and property schedules for the Federal evaluation of the Georgia and the Michigan Central Railroads. Then, for about a year and a half, he was resident engineer in charge of construction of a hydroelectric plant on the Black River near Cheboygan, Mich.

He became an instructor of Surveying at the University of Michigan in 1918 and was Professor of Surveying and Director of the University Surveying Camp at the time of his death. From 1925 to 1928, he was Professor of Railroad Engineering at Pei Yang University, Tientsin, China.

Professor Bouchard was the author of *Surveying*, a popular surveying text, and of a section on Surveying, Mapping, and Levelling in *General Engineering Handbook* (McGraw Hill).

He was a charter member of the American Congress on Surveying and Mapping. He also belonged to the American Society of Civil Engineers, American Society of Engineering Education, American Society of Photogrammetry, American Geophysical Union, American Association for the Advancement of Science, Society of American Military Engineers, Engineering Society of Detroit, Tau Beta Pi, Sigma Xi, and Chi Epsilon.

Harry Bouchard was an ardent advocate of thorough surveying training for engineering students. He was an excellent teacher and devoted all of his energies to serving the interests of those who studied under him. His students became friends, and he will be long and gratefully remembered by the hundreds who received instruction from him.

He is survived by his widow and three daughters.

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ACSM RECEIVES CERTIFICATE OF APPRECIATION

The American Congress on Surveying and Mapping has received a certificate from the American Society of Civil Engineers in appreciation of the part played by ACSM in the celebration of the Centennial of Engineering in Chicago in September 1952. The certificate states "this united effort demonstrated the importance of the art of engineering to the advancement of civilization."

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Notice

Members who have not yet paid 1953 dues are urged to do so before July 15 in order to avoid being declared delinquent for the year, with consequent removal of their names from the mailing list for the July–September issue.

NEW MEMBERS

INDIVIDUAL MEMBERSHIPS

ADLAND, E. R., Corps of Engineers, Clock Tower Bldg., Rock Island, Ill.—Chief, Surveys and Maps Branch, Rock Island District

AKSHARANUGRAHA, Lt. Som, c/o Francis J. Ortiz, U. S. Coast and Geodetic Survey, Washington, D. C.—Hydrographic Service, Royal Thailand Navy

ALEXANDER, Ira H., 3671 Colonial Ave., Venice, Calif.—Senior Civil Engineering Assistant, Geodetic Section, Los Angeles County

ANDERSON, Thomas D., 1408 Patrick Henry Dr., Falls Church, Va.—Cartographic Engineer, U. S. Geological Survey

ARMSTRONG, T. J., P.O. Box 1429, Jackson, Miss. —Field Engineer, Michael Baker, Jr., Inc.

BAINBRIDGE, Comdr. W. H., U. S. Coast and Geodetic Survey, P.O. Box 2039, Oakland, Calif.

BARNARD, John G., 608 Atlantic National Bank Bldg., Jacksonville, Fla.—Chief of Surveys and Maps, St. Regis Paper Co.

BATTERMAN, Richard H., Jr., 638 Pleasant St., Beloit, Wis.—Senior Partner, R. L. Batterman & Co., Engineers and Surveyors

BELL, Leo J., 63 Holland Ave., Lancaster, N. Y.— Civil Engineer, N. Y. State Dept. of Public Works

BERRY, Wilbur E., 2015 Cherri Dr., Falls Church, Va.—Photogrammetric Engineer, U. S. Forest Service

BETTIS, Donald L., 1134 Linda Vista, Pasadena 3, Calif.—Instrumentman, General Petroleum Co.

BHODHIPHALA, Lt. Comdr. Prapat, c/o Francis J. Ortiz, U. S. Coast and Geodetic Survey, Washington, D. C.—Hydrographic Service, Royal Thailand Navy

BILLS, Samuel E., P.O. Box 2831, Beaumont, Tex. —Section Head, Engineering and Mapping, Sun Oil Co.

BIRDSEYE, Charles W., U. S. Geological Survey, 1109 N. Highland St., Arlington, Va. — Cartographic Engineer

BLANCHARD, William W., Box 559, Burgaw, N. C. —Civil Engineer and Land Surveyor

BLECKLEY, Kenneth, 10 McGee St., Greenville, S. C.—Chief of Drafting, City Tax Atlas Project

BOROUGHS, J. C., P.O. Box 2096, Atlanta, Ga.— President, Taylor Survey Systems

BRADBERRY, Carroll E., P.O. Box 1153, 267 State St., Los Altos, Calif.—Consulting Engineer

BRAUN, John S., 6563 S. Canterbury Road, Parma, Cleveland 29, Ohio — Deputy County Engineer, Cuyahoga County, Ohio

BREHLER, Robert J., 9257 Burton Way, Beverly Hills, Calif.—Civil Engineer, Seaboard Engineering Co.

BRONSON, Edward A., P.O. Box 1429, Jackson, Miss. —Field Engineer, Michael Baker, Jr., Inc.

BROWN, Neil K., 1101 N. 5th St., Estherville, Iowa —Survey Engineer, Iowa State Conservation Committee

BRUCE, R. H., P.O. Box 512, 1937 Trinity Ave., Liberty, Tex.

BUSCHER, George F., 1973 84th Ave., Oakland, Calif.—Assistant Civil Engineer, Oakland, Calif.

BUSH, Martin L., P.O. Box 1429, Jackson, Miss.— Engineering Aide, Michael Baker, Jr., Inc.

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Notes on New Members

The 221 individual members listed on the preceding pages joined the Congress between January 1 and March 25, 1953. The list includes 28 memberships given by Michael Baker, Jr., Inc., to employees of that company. Most of the men are at present assigned to field duty in Alaska. More and more employers are recognizing the wisdom of taking out memberships for some of their employees.

Comments made by new members who had seen a copy of our Journal before joining the Congress included this one from Steward Cameron, Auckland, New Zealand, "The context of this publication together with the general aims of the Congress appeal so much to me that I enclose a draft of $6.00;" and from John Wilhelm, a licensed surveyor of La Jolla, Calif., "If your October–December issue is indicative of others, I am sure to swell your deserving coffers with orders."

Members are urged to tear out this page of the Journal, containing a membership application form, and send it to someone they believe should be a member of the Congress. Applicants should complete the form and sent it to the Chairman of the Membership Committee, P. O. Box 6244, Washington 15, D. C.

❦ ❦ ❦

APPLICATION FOR MEMBERSHIP

I am interested in surveying and mapping and hereby apply for membership in the American Congress on Surveying and Mapping. I enclose $5.00 (U. S. and Possessions), $6.00 (Foreign) in payment of annual dues.

Name (Please type or print) .....

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Occupation and Organization .....

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Reference. If registered, please indicate .....

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SURVEYING AND MAPPING

A QUARTERLY JOURNAL
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OF SURVEYING AND MAPPING

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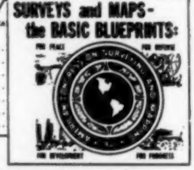
...engineers have had for years recourse to periodicals that furnish them a medium of exchange of technical knowledge. This is an excellent thing because it keeps the members of the profession well informed on the new and better ways of doing things. It also furnishes a wealth of background material that creates a broader and deeper perspective. Until recent years, the surveyors have not had a comparable medium of exchange of knowledge and ideas. This lack has now been met by the American Congress on Surveying and Mapping in the form of its publication Surveying and Mapping. Even though this is an excellent publication with every issue full of interesting and informative articles, those who need it most are not getting it and they don't know that it is being published.



Surveying and Mapping News

Members are requested to send in surveying and mapping news items for publication in Surveying and Mapping.—Editor.

CURRENT SURVEYING AND MAPPING LITERATURE

MAGAZINE ARTICLES

Comment and Discussion

CIVIL ENGINEERING VERSUS LAND SURVEYING

Forrest Daniels*—Many discussions have been published in Surveying and Mapping and elsewhere showing a healthy interest in the conflict between the civil engineer and the land surveyor. Milton O. Schmidt, an associate professor of civil engineering, University of Illinois, writes that it would be "fallacious to engage a civil engineer to make a property survey whose successful execution depended upon a thorough knowledge of land-line retracement procedures in a particular locality" (1). He likewise takes the position that the practicing land surveyor should not disclaim the possibility of a college-trained civil engineer being qualified to make an adequate land survey.

I have no doubt that a person who has the educational background of a civil engineer...

REFERENCES

(1) "College Training in Land Surveying," Surveying and Mapping, July–Sept. 1951, page 281.
(2) Comment and Discussion, Surveying and Mapping, Jan.–Mar. 1951, page 86.
(3) Comment and Discussion, Surveying and Mapping, Oct.–Dec. 1951, page 412.
(4) Presented at Second Texas Surveyors' Short Course, Dec. 5–6, 1941, Austin, Tex., (Report) page 49.
(5) Comment and Discussion, Surveying and Mapping, April–June 1951, page 179.
(6) "Surveying and Mapping in the Junior College," Surveying and Mapping, April 1943, page 47.
(7) Discussion in Surveying and Mapping, July 1943, page 11.
(8) "The Land Surveyor," Surveying and Mapping, July 1943, page 9.
(9) "A Reconnaissance," Surveying and Mapping, April 1944, page 2.
(10) Until recently the U. S. Census classified surveying as "and other semi-professional occupations."
(11) "Responsibilities of the Surveyor," Surveying and Mapping, July 1945, page 7.

MAP INFORMATION

This department was inaugurated for the purpose of bringing to the attention of the members information pertaining to the availability of maps, surveys, etc., with particular emphasis on how such material can be procured. Authoritative articles covering this class of information are solicited. It is believed that through an interchange and dissemination of such information maximum benefits will accrue to the surveying and mapping profession. —Editor

CONGRESS NEWS

Report of Property Surveying Handbook Committee of the Property Surveys Division

The Property Surveys Division of the American Congress on Surveying and Mapping has had under discussion for two years the preparation of a handbook on property surveying... first effort in this di...

...the preparation of a chapter to be called, for the time being, A Manual on Calculations for Property Surveying. Both Mr. George and Mr. Shartle are well equipped ... and have been ...

...subjects necessary ... handbook.

The Committee will welcome any and all calculation methods and short cuts, tables, or innovations that members may have developed in their own practice.

Sol A. Bauer
Committee Chairman

American Congress on Surveying and Mapping

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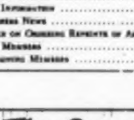

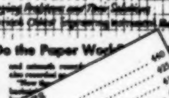

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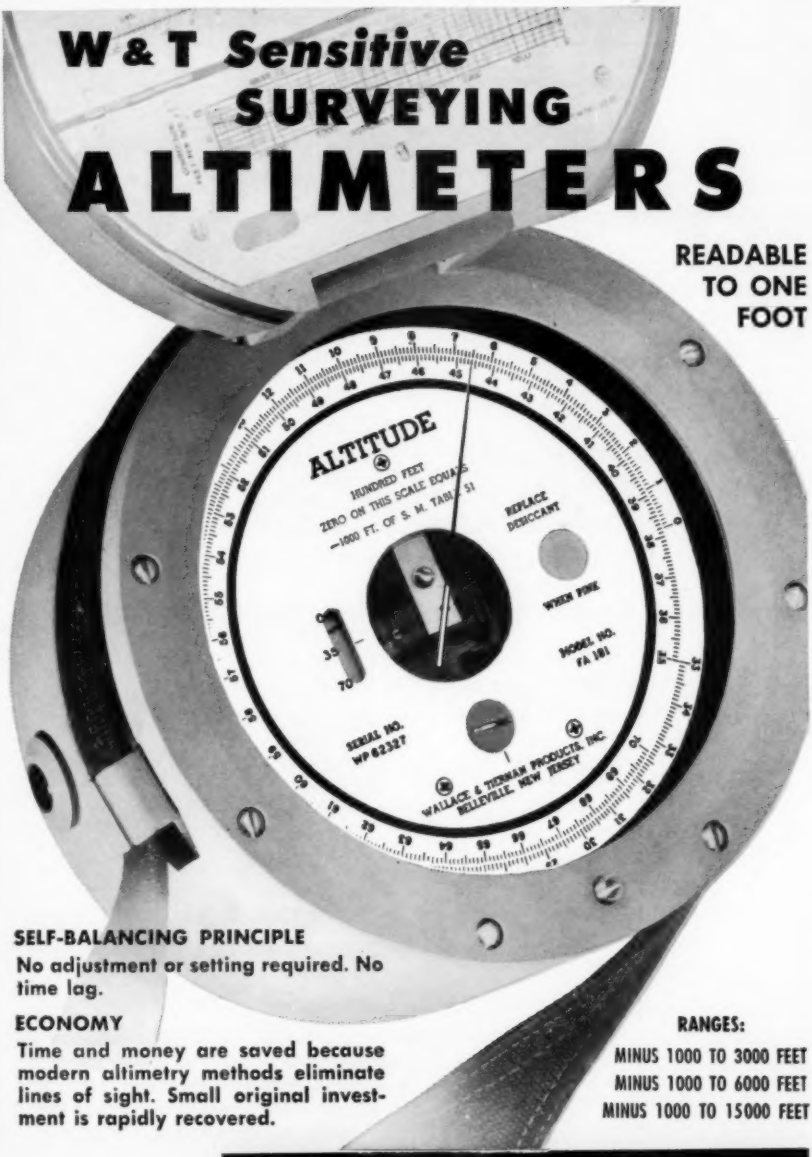

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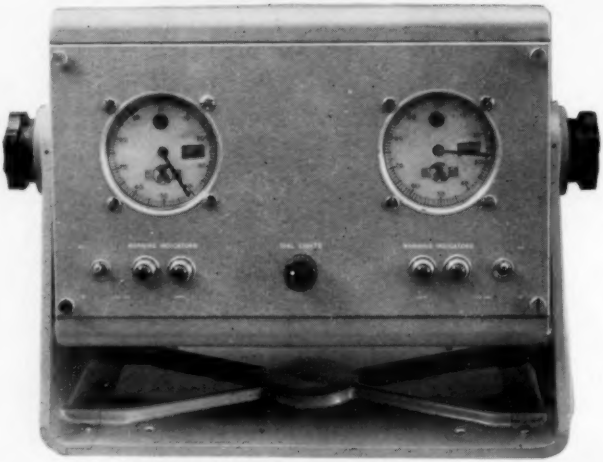

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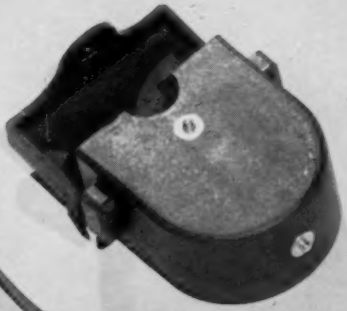

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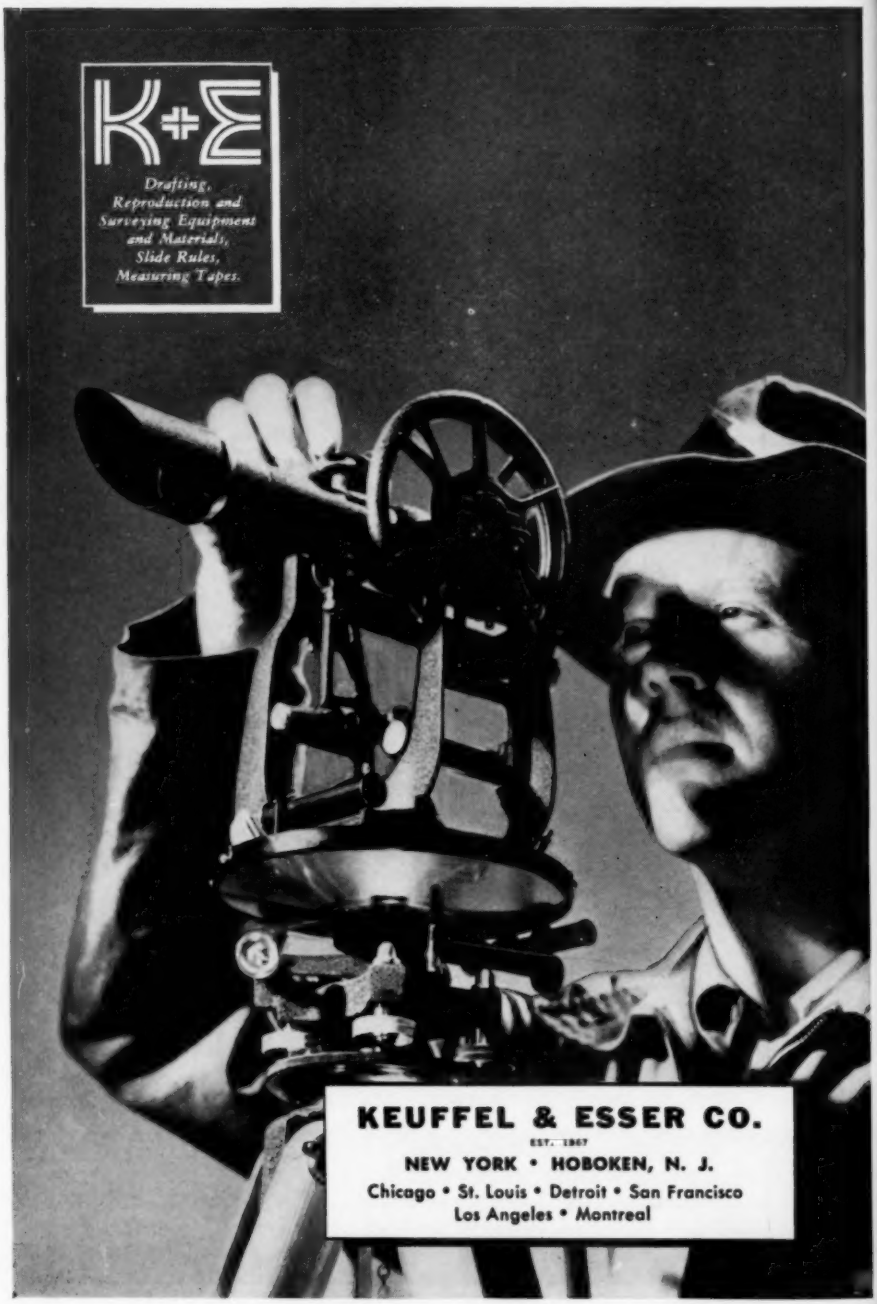
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